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Chargé de recherche au Muséum d'histoire naturelle de Genève

Comité de lecture

Il est constitué en outre du président de la Société suisse de Zoologie, du directeur du Muséum de Genève et de représentants des instituts de zoologie des universités suisses.

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REVUE SUISSE DE ZOOLOGIE 109 (2): 243-259; juin 2002

Two new species of the genus *Astyanax* (Characiformes, Characidae) from the Paraná river basin in Argentina

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Two new species of the genus *Astyanax* (Characiformes, Characidae) from the Paraná river basin, in Argentina. - *Astyanax leonidas* and *A. troya* are described from the río Paraná basin in northeastern Argentina. Both species share similar number of anal-fin rays and perforated scales in the lateral line, one maxillary tooth, a deep dentary and the presence of small hooks on pectoral, pelvic, anal, and caudal fin of males. These characters are also present in *A. ojiara* and separate the three species from the remaining species of the genus. *Astyanax leonidas* is differenciated by the robust body, dorsal profile almost straight, a long and slender maxillary tooth, teeth of premaxillary inner row with notable long central cusp, dentary teeth of similar shape than those of premaxilla, and 4 large dentary teeth followed by one intermediate tooth, and 3 or 4 small teeth. Also this species does not have hooks on dorsal-fin rays and pelvic axillary scale. *Astyanax troya* has a dorsal profile with marked concavity on supraoccipital area, one broad and low pentacuspid maxillary teeth, teeth of inner premaxillary row gently expanded distally with cusps arising in the same line, central cusp of premaxillary teeth scarcely longer, 8-10 dentary teeth decreasing in size anteroposteriorly, and males with hooks in all fins and pelvic axillary scale.

Key-words: Characiformes - Characidae - *Astyanax* - Paraná basin - Iguazú basin.

INTRODUCTION

The genus *Astyanax* is one of the most common genus in freshwaters of South America including about one hundred of nominal species (Garutti & Britski, 2000). According with these authors the most complete systematic revision of the genus was made many years ago by Eigenmann (1921, 1927), therefore a modern revision of *Astyanax* is long overdue.

In northeastern Argentina, the Sierra de Misiones crosses the province of the same name from the NE to the SW, separating the headwaters of many streams flowing into the Paraná and Uruguay river basins. In the last two decades, collecting

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efforts have shown the presence of poorly known species and several new ones (Casciotta *et al.,* 2000; Azpelicueta & Almirón, 2001; Almirón *et al.,* 2001). Among those findings, new species of *Astyanax* have been collected in different streams of both slopes.

One of them, *A. ojiara* (Azpelicueta & García, 2000) was described with material collected from the arroyo Yabotí, an affluent of the Uruguay river basin, and other species of the genus are under study. The objective of the present paper is to describe two new species of the genus *Astyanax* from affluents of the Paraná river basin.

MATERIAL AND METHODS

The specimens examined in this study were cleared and counterstained (C&S) following Taylor & Van Dyke (1985). Measurements are straight distances taken with calliper to nearest 0.1 mm. Peduncle length is the distance between last branched anal-fin ray and hypural joint.

Material is deposited in the Academy of Natural Science of Philadelphia (ANSP); Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata, Argentina (MLP); Fundación Miguel Lillo, Tucumán, Argentina (FML); Museo Argentino de Ciencias Naturales Bernardino Rivadavia (MACN); Muséum d'histoire naturelle de Genève, Genève, Switzerland (MHNG); Museu de Ciências, Pontificia Universidade Católica de Rio Grande do Sul, Porto Alegre, Brasil (MCP).

Comparative material (SL in mm). *Astyanax abramis* (Jenyns, 1842): MLP 9427, 2 ex., 102.0-113.0 mm, Argentina, Misiones, río Paraná. *Astyanax alburnus* (Hensel, 1870): MLP uncat., 5 ex., 40.5-47.2 mm, Uruguay, río Yaguarón. *Astyanax alleni* (Eigenmann & McAtee, 1907): MLP 6774, 5 ex., 50.0-64.2 mm, Argentina, Santa Fe, Laguna Setúbal. MLP 7255, 1 ex., 87.5 mm, Argentina, Santa Fe, río Paraná basin, Lago Parque Sur. *Astyanax asuncionensis* Géry, 1972: MLP 8660, 5 ex., 43.6-61.4 mm, Argentina, Santiago del Estero, Bañado de Añatuya. MLP 8844, 7 ex., 25.0-44.9 mm, Argentina, Formosa, río Bermejo basin, arroyo Mbiguá. *Astyanax eigenmanniorum* (Cope, 1894): ANSP 21627, paratypes, 2 ex., 42.5-49.4 mm, Brasil, Rio Grande do Sul (Photographs and measurements by L. Malabarba); MLP 9160, 6 ex., 37.3-70.6 mm, Argentina, Buenos Aires, Río de la Plata basin, laguna de Los Talas. MLP 2494, 13 ex., 30.0-53.1 mm, Argentina, Córdoba, río Quinto, Barreto. MLP 5202, 5 ex., 56.5-68.5 mm, Argentina, Córdoba, río Primero frente a Capilla de los Remedios. *Astyanax* cf. *fasciatus* (Cuvier, 1819): MLP 7115, 1 ex., 47.8 mm, Argentina, Santa Fe, río Paraná basin, San José del Rincón. MLP 8647, 5 ex. 34.0-45.8 mm, Argentina, Santiago del Estero, río Salado. *Astyanax leonidas* sp. n. (non type material), MLP uncat., 3 ex., 37.5-40.4 mm, Argentina, Misiones, río Iguazú basin, arroyo Lobo. *Astyanax ojiara* Azpelicueta & García: MLP 9470, holotype, 50.5 mm, Argentina, Misiones, arroyo Benítez, headwaters of río Yabotí, an affluent of río Uruguay. *Astyanax troya* sp. n. (non-type material), MLP uncat., 1 ex., 87.0 mm, Argentina, Misiones, río Paraná near Eldorado.

Cleared and stained material (Personal collection): *Astyanax abramis*: 2 ex., 74.5-92.0 mm, Argentina, Buenos Aires, río de la Plata in Punta Lara; 2 ex., 80.6-98.8

mm, Argentina, Misiones, río Piray-Miní, 2 ex., 62.4-72.9 mm, Argentina, Corrientes, río Riachuelo. *Astyanax asuncionensis*: 2 ex., 28.0-37.6 mm, Argentina, Santa Fe, Isla Los Sapos; 2 ex., 80.4-92.7 mm, Argentina, Misiones, río Uruguay in San Isidro. *Astyanax eigenmanniorum*: 2 ex., 17.7-33.0 mm, Argentina, Buenos Aires, desembocadura del río Colorado; 2 ex., 28.0-30.5 mm, Argentina, Buenos Aires, Laguna de Gómez; 1 ex., 60.3 mm, Argentina, Buenos Aires, río de la Plata; 1 ex., 45.0 mm, Brasil, Rio Grande do Sul, Viamão, açude Charolês. *Astyanax* cf. *fasciatus*: 2 ex., 91.0-106.5 mm, Argentina, Misiones, río Uruguay in San Isidro. *Astyanax leonidas* sp. n., 3 males, 3 females, 33.0-45.6 mm, collected with the holotype. *Astyanax ojiara*: 3 females, 46.2-71.0 mm; 7 males, 37.8-58.0 mm, Argentina, Misiones, arroyo Benítez. *Astyanax troya* sp. n.: 3 ex., 76.0-81.5 mm, collected with the holotype. *Astyanax* sp. A, 3 ex., 66.2-68.5 mm, Argentina, Misiones, arroyo Yabotí.

RESULTS

Astyanax leonidas sp. n. Figs 1-4, 6, 8, 12; Table 1

Holotype. MLP 9580, male, 45.6 mm SL, Argentina, Misiones, río Paraná basin, headwaters of arroyo Urugua-í (26° 10' S-53° 41' W), coll. J. R. Casciotta, October 1998.

Paratypes (collected with the holotype). MLP 9581, 4 ex. (1 male and 3 females), 38.8-39.3 mm SL. MHNG 2624.29, 11 ex. (7 males and 4 females) 37.3-45.4 mm SL.

Diagnosis. Astyanax leonidas is distinguished by the following combination of characters: one maxillary tooth long and slender with three or four cusps; teeth of premaxillary inner row with long central cusp; dentary with four large teeth, followed by a median one and three or four very small teeth; males with hooks in anal, caudal, pectoral, and pelvic fins; 35-37 perforated scales in the lateral series; and iii-iv,17-21 anal-fin rays. The dorsal profile of body is straight or slightly curved. The species has a first humeral spot vertically elongated and a second one faint and irregular in shape.

Description. Morphometrics of holotype and 15 paratypes are presented in table 1. *Astyanax* with low body, maximum body depth before dorsal-fin origin (Fig. 1). Dorsal profile of body straight from snout to posterior tip of supraoccipital process, slightly convex from this point to dorsal-fin origin, rather straight from dorsal-fin origin to adipose fin. Dorsal profile of caudal peduncle slightly convex. Ventral profile of body curved, caudal peduncle slightly concave ventrally.

Dorsal-fin origin almost equidistant from tip of snout and base of caudal-fin rays. Pelvic-fin origin a little before vertical through dorsal-fin origin. Adipose fin anterior to base of last branched anal-fin rays. Tip of pectoral fin reaching pelvic-fin origin in males; in females, pectoral fin short, not reaching pelvic-fin origin. Tip of pelvic fin close to anal-fin origin in males; in females, pelvic-fin tip far from that point.

Dorsal fin iii,9; first one only visible in cleared and stained specimens. Posterior margin of dorsal fin straight, second branched dorsal-fin ray longest. Males without hooks on rays.

Anal-fin iii-iv, 17-21 (holotype = iv,19). Posterior margin almost straight in males; in females, first six branched rays produced forming a small lobe. Anal fin of

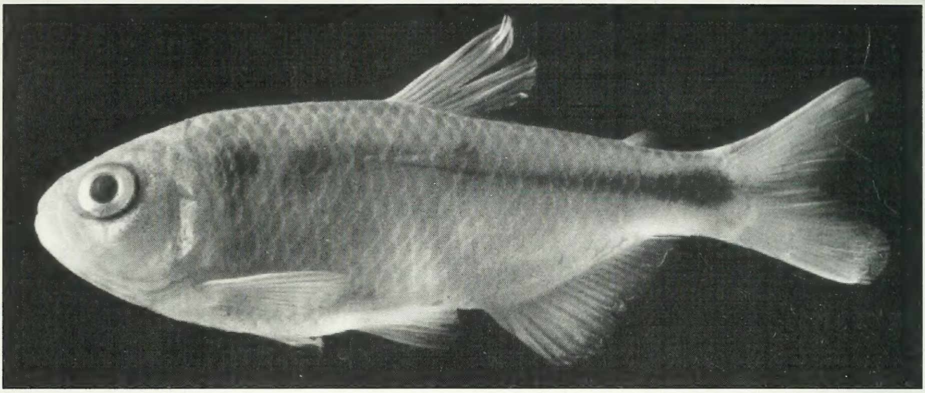


FIG. 1

Astyanax leonidas sp. n., holotype, MLP 9580, male, 45.6 mm SL, Argentina, Misiones, río Paraná basin, headwaters of arroyo Urugua-í.

males with hooks directed posteriorly and outward, slightly curved dorsally. Hooks on last unbranched ray and 1st to 14th (no less than 9th) branched anal-fin rays. Hooks placed on all branches of ray, frequently on posterior branches; sometimes two or three pairs on each segment.

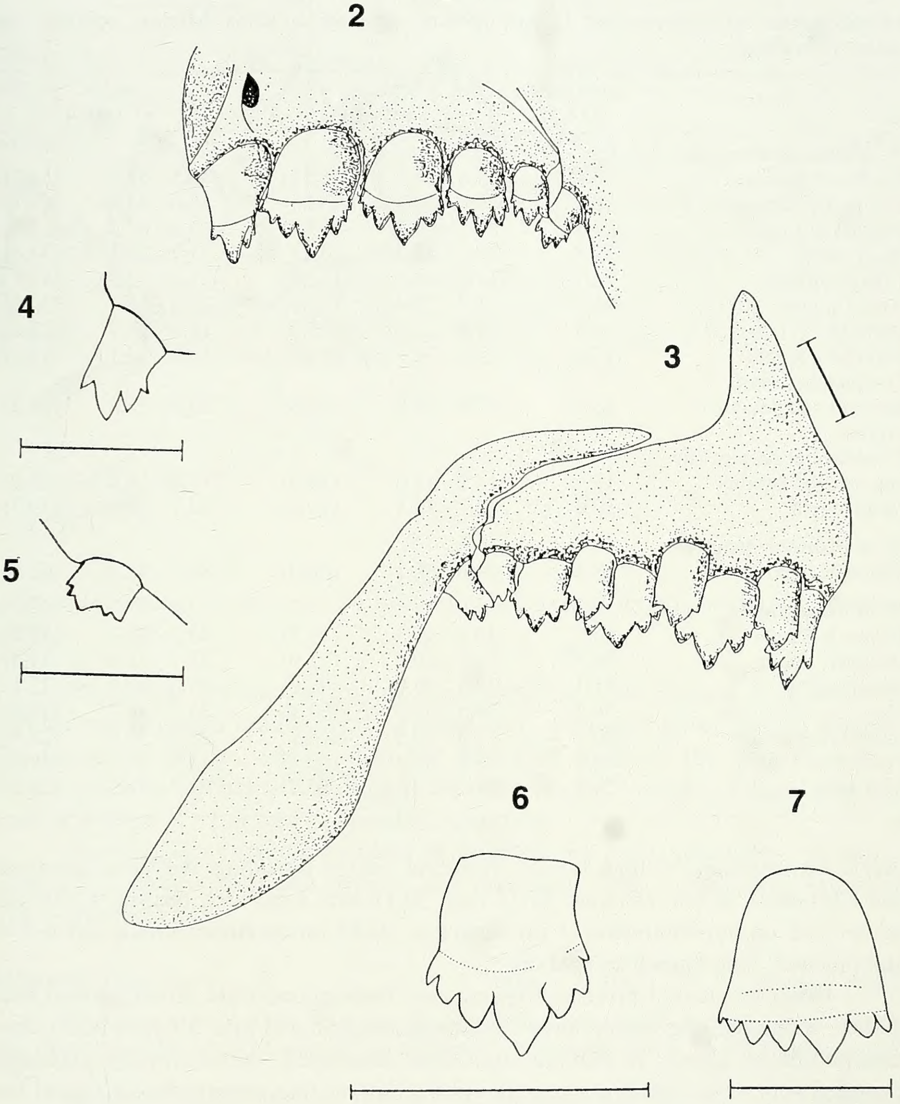
Caudal fin bearing 10/9 (dorsal/ventral) principal rays and 10-11/8-12 procurrent rays. Caudal lobes similar in size. One or two pairs of hooks placed on distal tips of middle caudal-fin rays in males.

Pectoral-fin rays i,11-12 (holotype = i,11). Hooks placed on dorsal portion of rays and directed dorsally; one or two hooks on each segment, usually only one hook. Hooks on first unbranched ray and first 5 or 7 branched rays.

Pelvic fin i,7; hooks developed on inner branches of 2nd to 6th branched rays; one hook on each segment.

Head length less than 1/3 of SL, mouth terminal and horizontal; snout short. Lower and upper jaws equal in length. Premaxilla with short ascending process, alveolar process bearing two series of teeth (Figs 2-3). Outer series with 4 tricuspid or pentacuspid teeth (3 teeth in 1 ex.), central cusp larger. Inner series with 4 or 5 (usually 5) teeth; teeth bearing 3 to 7 cusps (Figs 2, 6). Second tooth of inner series larger, fifth smaller; symphysial tooth with 4 cusps, second to fourth with 5 to 7 cusps, fifth tooth with 3 or 4 cusps (Figs 2, 6). Maxilla long, scarcely lobed posteriorly, reaching vertical through middle orbital diameter. One or two maxillary teeth (usually only one), with 3 or 4 cusps (Figs 3, 4). Dentary bearing 4 large and 1 medium sized teeth with 5 or 6 cusps, 3 or 4 smaller teeth with 1 or 3 cusps; all teeth with central cusp larger (Fig. 8).

Scales cycloid. Lateral series with 35-37 perforated scales (5 ex.= 35, 7 ex. including holotype= 36, 4 ex.= 37). Lateral line running on lower half of caudal peduncle, ending in a long tube without lamina between caudal rays. Six to seven scales between dorsal-fin origin and lateral line; 5 between lateral line and anal-fin origin (holotype 6/5). Eleven or twelve scales forming a regular row between



FIGS 2-7

Figs 2-4,6: *Astyanax leonidas* sp. n., 42.2 mm SL, right upper jaw; 2, inner series of premaxillary teeth and maxillary tooth in lingual view; 3, premaxilla and maxilla in labial view; 4, detail of maxillary tooth; 6, detail of 3rd tooth of inner premaxillary row. Figs 5, 7: *Astyanax troya* sp. n., 81.5 mm SL, details of teeth; 5, maxillary tooth; 7, third tooth of inner premaxillary row. Scales = 1 mm.

supraoccipital process and dorsal-fin origin. Eight to fifteen (mode= 10) scales placed on anal-fin base, covering all unbranched and first 8 to 12 branched anal-fin rays. Scales placed on basal caudal-fin lobes. A narrow axillary scale present dorsal to

TABLE 1

Morphometrics of holotype and 15 paratypes of *Astyanax leonidas*. Minima, maxima, and means in brackets.

	holotype	females		males	
SL	45.6	39.0-47.6		37.3-45.4	
% of standard length					
Predorsal distance	50.8	49.6 - 54.1	(52.7)	49.5 - 53.6	(51.3)
Preventral distance	46.0	48.7 - 52.3	(50.3)	46.0 - 51.8	(49.1)
Preanal distance	64.4	65.2 - 69.2	(67.2)	64.4 - 67.6	(65.9)
Body depth	33.3	30.2 - 35.3	(32.7)	31.7 - 35.1	(33.7)
Dorsal-fin base	12.7	11.3 - 13.3	(12.1)	11.4 - 12.7	(12.1)
Anal-fin base	24.3	21.8 - 25.4	(23.8)	23.6 - 27.1	(24.9)
Pectoral-fin length	22.8	19.8 - 23.3	(21.3)	19.6 - 23.7	(22.1)
Pelvic-fin length	17.5	15.4 - 16.7	(15.8)	16.0 - 19.1	(17.9)
Distance between pectoral and pelvic-fin origins	25.0	22.6 - 26.9	(24.8)	23.4 - 25.3	(24.5)
Distance between pelvic and anal-fin origins	19.9	18.2 - 21.0	(19.3)	17.4 - 19.9	(19.0)
Head length	30.0	28.7 - 32.8	(30.5)	22.7 - 31.4	(29.7)
% of peduncle length					
Peduncle depth	88.3	71.6 - 86.1	(80.0)	80.7 - 91.4	(86.6)
% of head length					
Peduncle length	43.7	45.5 - 49.5	(47.3)	43.2 - 47.7	(45.3)
Peduncle depth	38.7	34.9 - 40.0	(37.0)	37.7 - 41.0	(39.4)
Snout length	21.1	20.3 - 25.0	(22.9)	21.0 - 23.8	(22.1)
Eye	34.3	34.3 - 39.0	(37.3)	34.3 - 41.2	(36.9)
Interorbital length	29.1	27.3 - 29.5	(28.7)	26.9 - 30.4	(28.8)
Postorbital length	45.9	48.8 - 52.4	(50.4)	45.9 - 52.3	(49.0)
Maxillary length	26.2	22.7 - 27.1	(25.7)	21.7 - 28.5	(25.5)

pelvic-fin insertion, without hooks. Vertebral counts including Weberian apparatus and CU1+PU1 as one element: 32 (5 ex.), 33 (1 ex.). First arch bearing 17-19 gill-rakers: 1-2 on hypobranchial, 1 on cartilage, 10-11 on ceratobranchial, and 6-7 on epibranchial. Four branchiostegal rays.

Color of alcohol preserved specimens: Background light brown, dorsal head darker, with small chromatophores on opercular region and lips. Medium sized chromatophores on cheek. A humeral spot well developed, dorsoventrally expanded. Humeral spot wide (three scales wide) above lateral line system, below lateral line narrow, one scale wide. A second lateral spot placed above lateral line, starting 3 scales backward from humeral spot. Lateral spot very faint and smaller, usually irregular in shape. A clear area between humeral and lateral spots. A dark lateral band with different intensity in coloration and width crossing flanks. Lateral band origin close to lateral spot, anterior portion of it faint, wider posteriorly ($1^1/_2$ scale wide), ending in a caudal spot. Middle caudal-fin rays with chromatophores. Dark chromatophores on distal margin of anal fin, forming a faint band. Dorsal-fin rays and membranes with black chromatophores, more evident on distal portion. Black chromatophores on distal margin of fin and ray margins. Pectoral and pelvic fins hyaline.

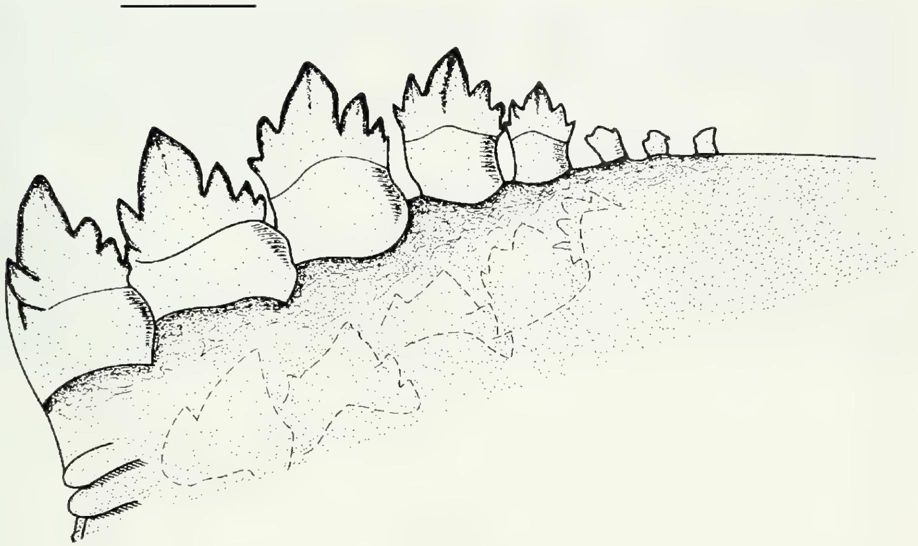


FIG. 8

Astyanax leonidas sp. n., 42.2 mm SL, right lower jaw, dentary teeth in lingual view. Scale = 1 mm.

Etymology. The specific epithet *leonidas* refers to the Spartan King Leonidas who heroically fought a million-man Persian army with only three hundred soldiers. The battle, in which Leonidas lost his life, took place in the narrow pass of Termopilas. This epithet is dedicated to all the academic teachers of Argentina that stand in defense of a free and independent education.

Distribution. *Astyanax leonidas* is only known from headwaters of arroyo Urugua-í, río Paraná basin and arroyo Lobo, río Iguazú basin, in Misiones, Argentina (Fig. 9, localities 1-2).

Astyanax troya sp. n. Figs 5, 7, 10-11, 13-18, 20-21; Table 2

Holotype. MACN 8310, 73.8 mm SL, Argentina, Misiones, arroyo Cuñapirú Chico, near its mouth in the arroyo Cuñapirú, an affluent of río Paraná, coll. E. D. Rodríguez, August 1993.

Paratypes. FML 3250, 4 ex., 50.5-75.4 mm SL, Argentina, Misiones, coll. Azpelicueta & Braga, arroyo Tabay, October 1987. MHNG 2624.30, 8 ex., 72.4-81.7 mm SL, Argentina, Misiones, arroyo Cuñapirú in Balneario de Aristóbulo del Valle, coll. U. Pardiñas, September 1995. MCP 28438, 5 ex., 76.2-82.4 mm SL, collected with the holotype.

Diagnosis. The species is distinguished by a combination of characters: one maxillary tooth with five cusps, maxillary tooth low and broad; teeth of inner premaxillary row very gently expanded distally, with central cusp not too long, and all cusps arising at same line; 8-10 dentary teeth decreasing in size anteroposteriorly; males with hooks in all fins, and large specimens with 1 or 2 hooks on pelvic axillary scale; 34-37 perforated scales in lateral series; and iv-v,18-21 anal-fin rays. Dorsal

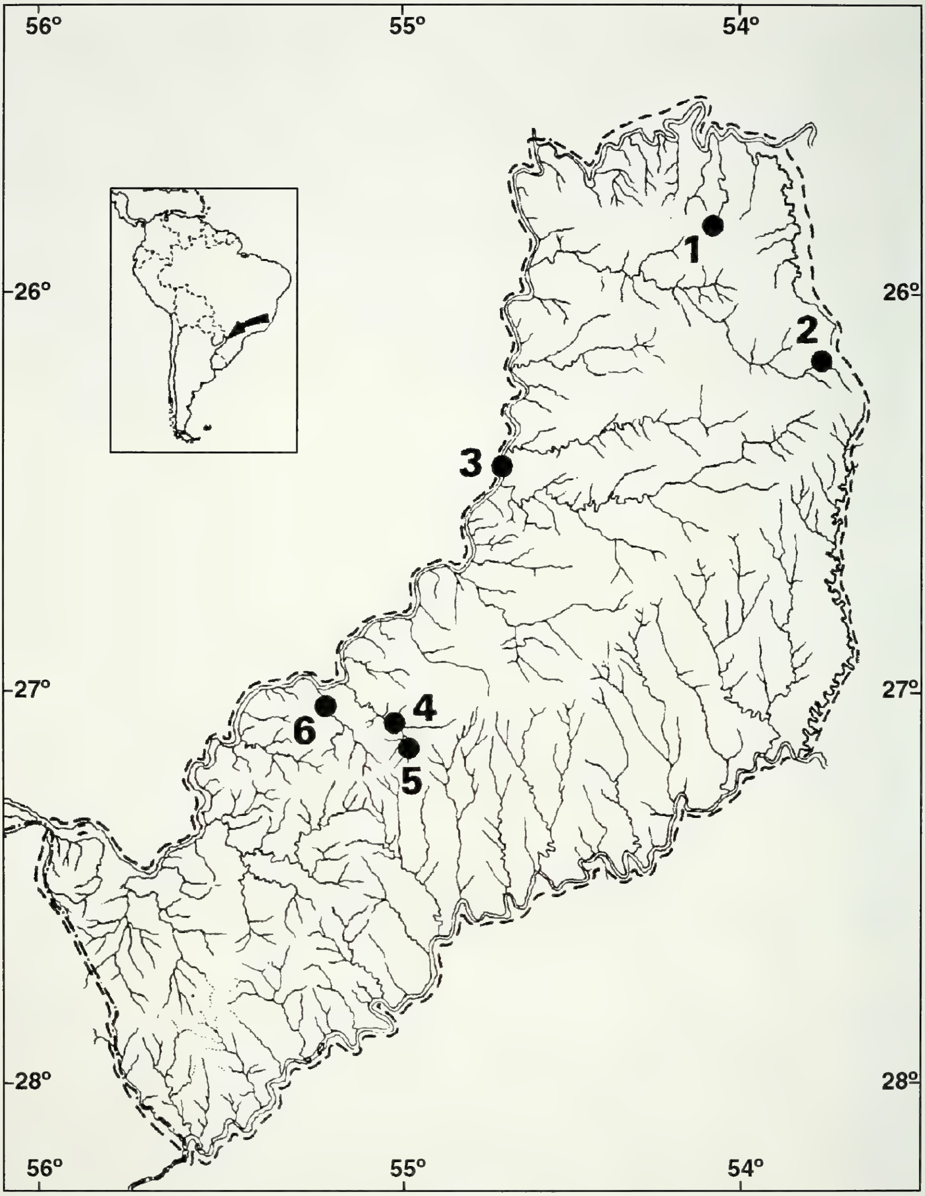


FIG. 9

Geographical distribution of *Astyanax leonidas* sp. n. (1, 2) and *A. troya* sp. n. (3-6) in Argentina, Misiones, río Paraná basin. 1, arroyo Lobo; 2, headwaters of arroyo Urugua-í; 3, río Paraná near Eldorado; 4, arroyo Cuñapirú Chico; 5, arroyo Cuñapirú; and 6, arroyo Tabay.

profile of body concave over supraoccipital area. One humeral spot rounded or horizontally enlarged bounded by a light area, with chromatophores forming a well developed vertical band placed ventral to the spot; a second faint humeral spot present.

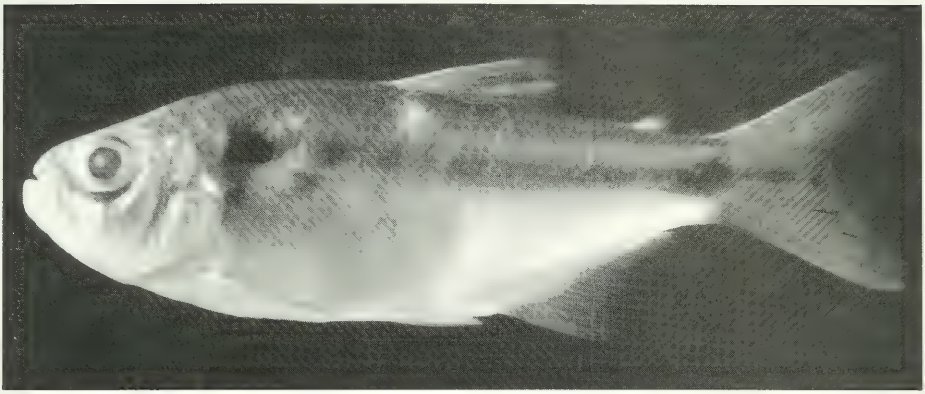


FIG. 10

Astyanax troya sp. n., holotype, MACN 8310, male, 73.8 mm SL, Argentina, Misiones, río Paraná basin, arroyo Cuñapirú Chico.

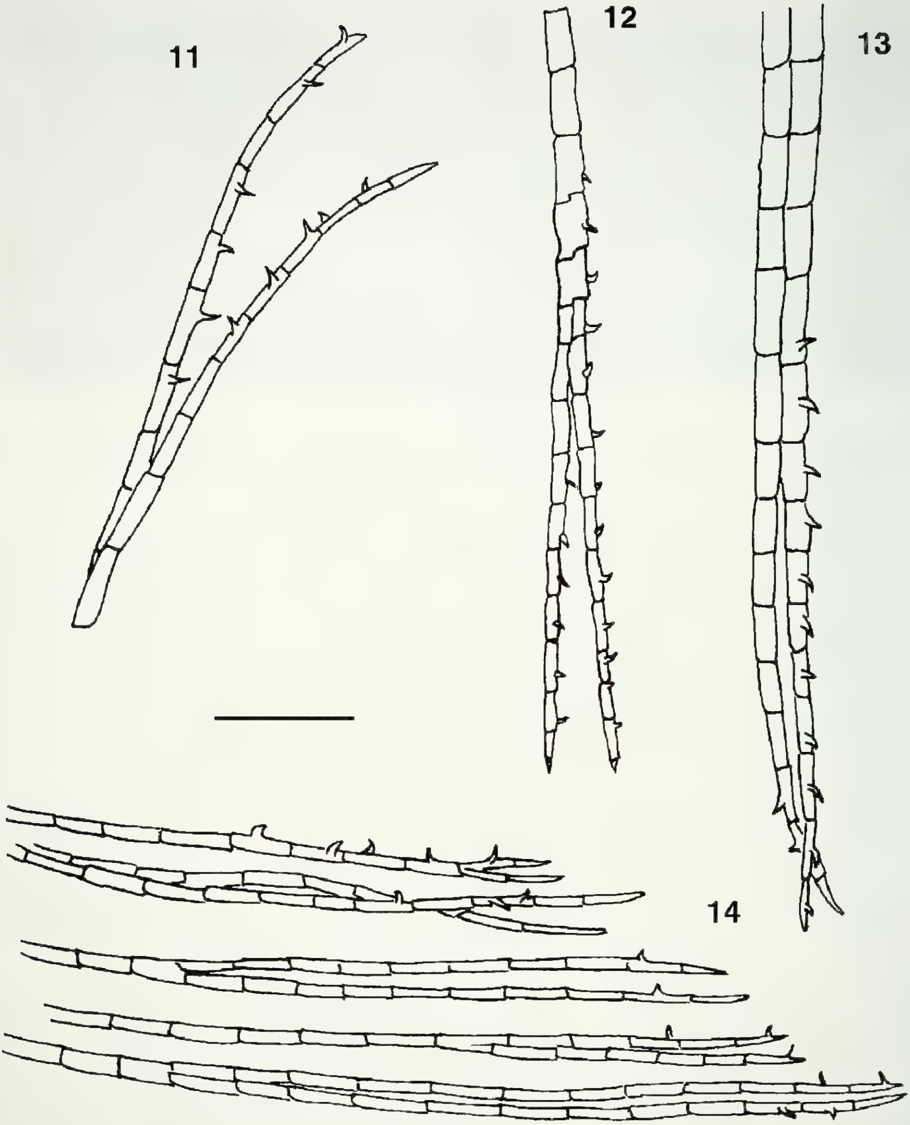
Description. Morphometrics of holotype and 17 paratypes are presented in table 2. A species of *Astyanax* with low body (Fig. 10), and maximum body depth at dorsal-fin origin. Dorsal profile of body convex on snout, concave over eye and supraoccipital region, angled behind supraoccipital process, gently curved from supraoccipital area to origin of dorsal fin, slanted ventrally from dorsal-fin origin to caudal peduncle, almost straight in some large specimens. Dorsal profile of caudal peduncle scarcely concave or straight; ventral profile convex. Ventral profile of body curved from tip of lower jaw to pelvic-fin origin, straight between pelvic fin and anal-fin origin, and slanted dorsally to caudal peduncle. Body rounded between pectoral and pelvic fins; body laterally compressed between pelvic and anal fins.

Dorsal-fin origin almost equidistant from tip of snout and base of caudal-fin. Pelvic-fin origin anterior to vertical through dorsal fin-origin. Adipose fin very small, anterior to base of last branched anal-fin rays. Tip of pectoral fin never reaching pelvic-fin origin; tip of pelvic fin always far from anal-fin origin (Fig. 10).

Dorsal fin with iii,9 rays; posterior margin of dorsal fin slightly rounded, first branched dorsal-fin ray longest. In males, tip of dorsal-fin rays, excluded last one and unbranched rays, with very small and slender hooks, directed outward and backward (Fig. 11), one pair on each segment, until 8 pairs on each ray.

Anal-fin with iv-v, 18-21 rays (holotype = iv,21). Posterior margin almost straight; in some specimens, two or three branched rays produced forming a small lobe. Anal fin of males bearing small hooks on all branched rays, directed outward and scarcely curved dorsally; one pair of hooks on each segment, until 10 pairs on each ray (Fig. 13).

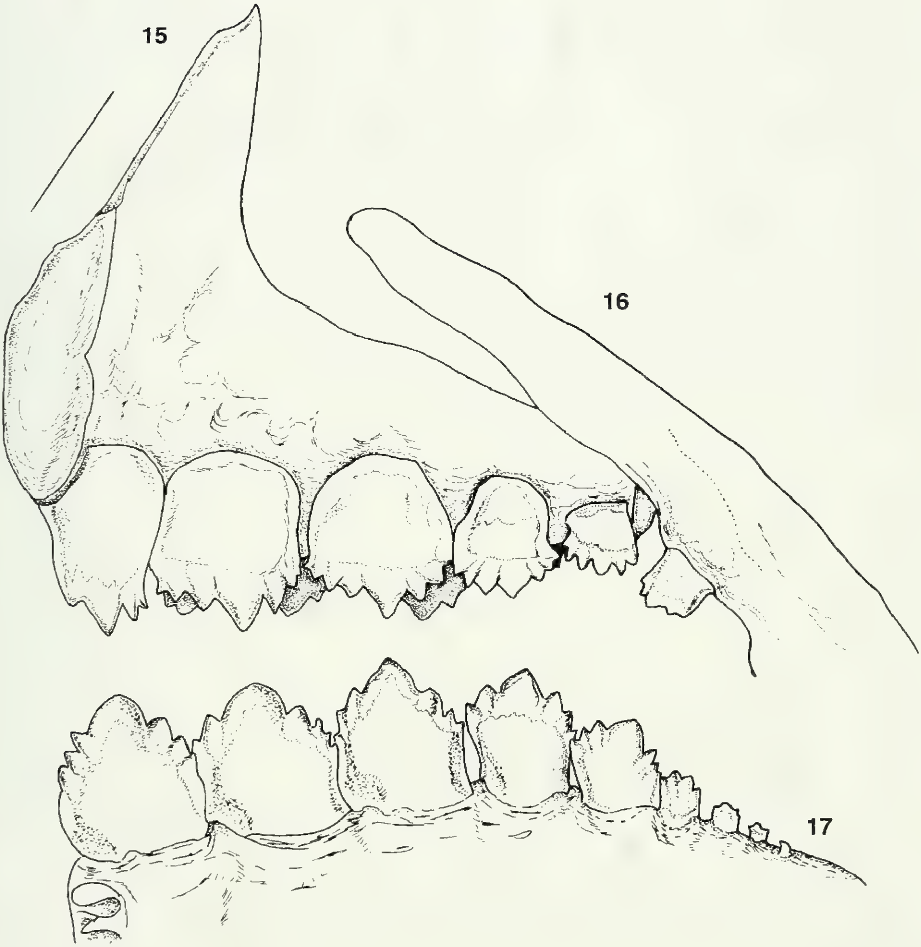
One unbranched and 9 branched principal caudal-fin rays in upper lobe; 8 branched and 1 unbranched principal rays in lower lobe; lower lobe usually larger. In mature males, few very slender hooks occurring on distal tips, especially on middle caudal-fin rays (Fig. 14). Hooks more numerous on upper lobe, no more than 7 pairs on each ray.



Figs 11-14

Figs 11, 13-14. *Astyanax troya* sp. n., male, 81.5 mm SL, left view. 11, third dorsal-fin ray; 13, detail of hooks on posterior branch of third anal-fin ray; 14, detail of hooks on middle caudal-fin rays of the lower lobe. Fig. 12. *Astyanax leonidas* sp. n., male, 42.2 mm SL, left view of third branched anal-fin ray. Scale = 0.5 mm.

Pectoral-fin with i,10-12 rays (holotype = i,12). Posterior margin of pectoral fin straight or scarcely rounded. Few very small and slender hooks on tips of three or four first branched rays in large males.

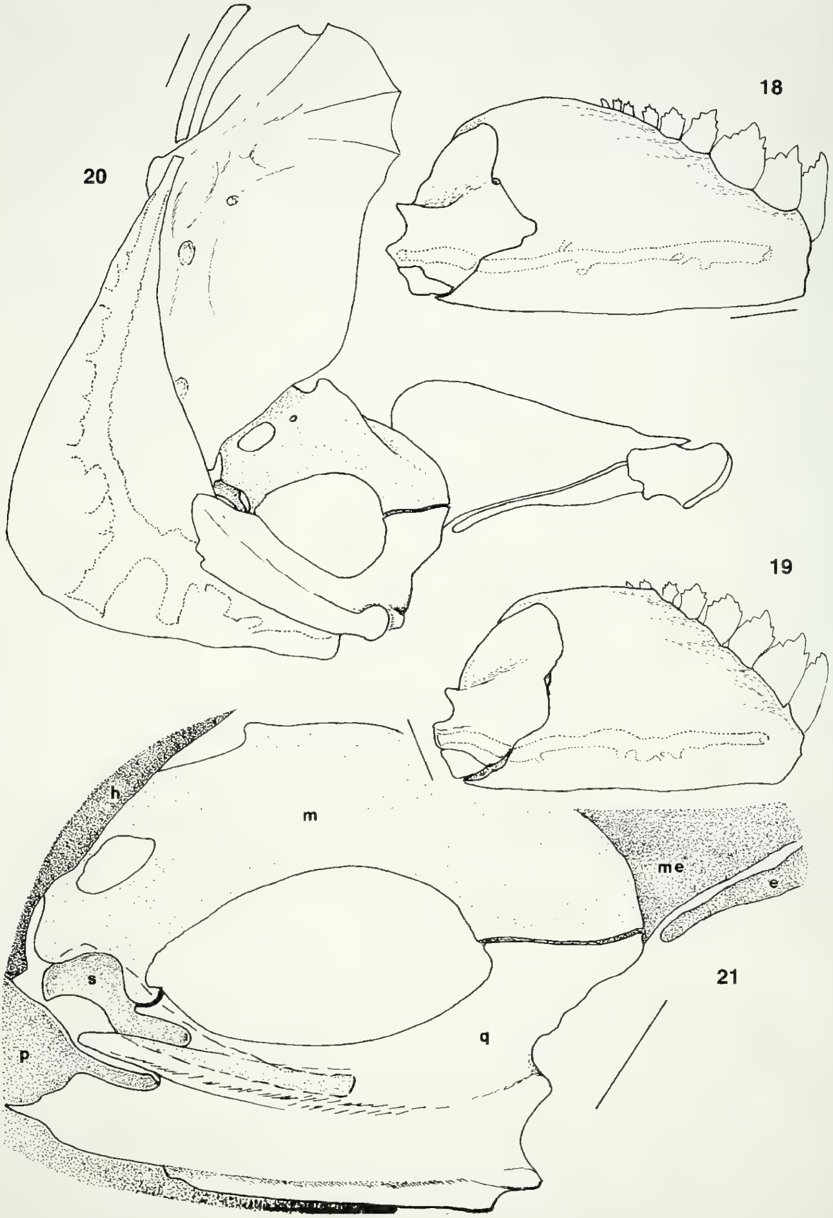


Figs 15-17

Astyanax troya sp. n., 81.5 mm SL, right lingual view. 15, premaxilla, inner row of premaxillary teeth, with tips scarcely expanded; 16, maxilla with pentacuspid tooth; 17, dentary with teeth decreasing in size. Scale = 1 mm.

Pelvic fin with i,7 rays, posterior margin of fin slightly rounded. Hooks developed on branched rays of males, especially on their tips. One pair of hooks on each segment, few pairs on each ray, curved dorsally.

Head length moderate, mouth terminal, horizontal; snout short. Lower jaw slightly longer than upper jaw. Premaxilla with short ascending process, and long alveolar process. Premaxilla with two series of teeth, each tooth with a central cusp larger. Outer row with 4 to 6 tetracuspid or pentacuspid teeth. Inner series of premaxilla with 5 teeth (5 specimens with 4) very gently expanded distally; symphysial tooth slender, with 5 cusps; remaining teeth with 5 to 8 cusps (Figs 7, 15), central



FIGS 18-21

Figs 18-19. Lower jaw, rigth external view, scale = 1 mm. 18, *Astyanax troya* sp. n., 76.0 mm SL; 19, *A. ojiara*, 71.0 mm SL. Figs 20-21: *A. troya* sp. n., 81.5 mm SL, external view of right suspensorium. 20, scale = 1 mm; 21, detail of the posteroventral metapterygoid process suturing with medial process of quadrate; scale = 0.5 mm; **e**, ectopterygoid; **h**, hyomandibula; **me**, mesopterygoid; **m**, metapterygoid; **p**, preopercle; **q**, quadrate; **s**, symplectic.

TABLE 2

Morphometrics of holotype and 17 paratypes of *Astyanax troya*. Minima, maxima, and means in brackets

	holotype	females		males	
SL	73.8	71.6-82.4		72.8-81.4	
% of standard length					
Predorsal distance	53.6	51.6 - 55.3	(53.2)	50.4 - 54.6	(52.9)
Preventral dictance	52.0	47.4 - 52.2	(50.2)	46.0 - 51.8	(48.6)
Preanal distance	69.3	65.4 - 73.3	(69.4)	61.8 - 69.7	(67.3)
Body depth	34.1	33.0 - 40.9	(36.6)	34.0 - 40.1	(36.1)
Dorsal-fin base	13.5	12.4 - 14.9	(13.5)	11.7 - 14.4	(13.5)
Anal-fin base	26.8	22.9 - 28.6	(25.7)	23.9 - 28.8	(26.3)
Pectoral-fin length	22.3	20.1 - 23.6	(22.1)	20.3 - 23.4	(21.9)
Pelvic-fin length	17.4	15.3 - 18.3	(16.5)	15.4 - 19.3	(16.8)
Distance between pectoral and pelvic-fin origins	25.4	22.6 - 27.3	(24.6)	23.2 - 25.7	(24.3)
Distance between pelvic and anal-fin origins	19.3	17.4 - 23.8	(20.5)	16.5 - 22.1	(19.9)
Head length	28.8	27.5 - 30.9	(28.2)	26.9 - 30.0	(28.5)
% of peduncle length					
Peduncle depth	90.8	76.3 - 95.6	(87.8)	70.0 - 93.5	(82.6)
% of head length					
Peduncle lengtht	46.0	41.4 - 51.5	(45.1)	43.3 - 52.2	(49.0)
Peduncle depth	41.7	36.6 - 42.1	(39.6)	38.9 - 43.1	(40.5)
Snout length	26.2	22.9 - 28.4	(25.7)	24.7 - 28.9	(27.0)
Eye	38.4	35.0 - 42.6	(38.1)	35.1 - 44.6	(38.2)
Interorbital length	31.4	29.7 - 33.3	(30.9)	27.6 - 33.4	(30.2)
Postorbital length	52.1	43.2 - 53.8	(49.2)	44.6 - 52.1	(49.5)
Maxillary length	25.8	21.2 - 26.6	(24.1)	21.0 - 27.6	(23.5)

cusp scarcely longer than remaining cusps, all cusps arising at same line. Maxilla with long anterodorsal and laminar processes, always surpassing vertical through anterior orbital margin; one pentacuspid maxillary tooth (two specimens without maxillary tooth); maxillary tooth broad and low (Figs 5, 16). Dentary with 8-10 teeth decreasing in size anteroposteriorly; those teeth with broad bases, and central cusp larger. Symphysial tooth narrower, with 7 cusps. Second tooth with 7 or 8 cusps, third to fifth teeth with 6 or 7 cusps; sixth to eighth teeth pentacuspid or tricuspid, nineth tooth tricuspid or unicuspid- and tenth tooth when present- unicuspid (Figs 17-18).

Eye large, interorbital area convex. Six infraorbitals well developed; third infraorbital not reaching sensory tube of preopercle. Scales cycloid, with several radii on posterior field. Lateral series with 34-37 perforated scales (1 ex. = 34, 2 ex. = 35, 11 ex. = 36, 4 ex. including holotype = 37); lateral line running on lower half of caudal peduncle. Five or 6 scales between dorsal-fin origin and lateral line; 5 scales between lateral line and ventral-fin origin. Fifteen or sixteen scales around caudal peduncle. Ten to twelve scales forming a regular row between supraoccipital process and dorsal-fin origin. Nine to twelve rectangular scales placed on anal-fin base, covering all unbranched and nine to twelve branched anal-fin rays. Scales covering basal fifth of caudal lobes. Pelvic axillary scale present, bearing one or two hooks in its posterior inner area in large males.

Osteological characters: In three cleared and stained specimens, first arch bearing 17-18 gill-rakers: 1 on hypobranchial, 1 on cartilage, 9 on ceratobranchial, and 6-7 on epibranchial. Four branchiostegal rays. Eleven or twelve (2 ex.) pairs of ribs. Vertebral counts including Weberian apparatus and CU1+PU1 as one element: 30 (2 ex.) and 31; fourteen (2 ex.) or sixteen precaudal vertebrae. Four anal-fin rays on first pterygiophore of same fin. Caudal fin bearing 11-12 dorsal and 9-10 ventral procurrent rays.

Pterosphenoid bone with a median crest, horizontally placed. Posterior arm of metapterygoid with a curved ventral process, directed anteriorly, suturing with a dorsomedial process of quadrate and also with symplectic (Figs 20-21).

Coloration uppon capture: Upper half of body darker, wide lateral band gray ending in a caudal spot, lower half silvery. Some specimens with a blotch dark, on central area of dorsal fin, and anterior margin of this fin white. Basal half of caudal lobes red, middle caudal rays faint gray, caudal fin margin hyaline or black. First rays of anal fin white, base of anal-fin red or faint red, and most specimens with anal-fin margin black. Pelvic fin redish near its origin.

Color of alcohol preserved specimens: Background pale, dorsal region of flanks and head darker, one black midline along body on dorsum. Rounded to subcircular humeral spot well developed, bounded by a clear area, and extended ventrally by a narrow band of small black chromatophores. Second lateral spot well developed or faint. Deep dark lateral band extending from second humeral spot to caudal peduncle, covered on posterior half by other superficial band of gray chromatophores.

Two or three first dorsal rays with black chromatophores; dark chromatophores forming a spot on tip of dorsal-fin rays in most males. Large black chromatophores on distal margin of anal fin, forming a faint band in some specimens. Middle caudal-fin rays black; tip of caudal-fin rays with dark chromatophores. Pectoral and pelvic fins hyaline, few chromatophores along ray surfaces.

Chromatophores completely covering scales surface on upper half of flank, although leaving a marginal light area, forming a reticulate pattern; limit of scales bounded by black minute chromatophores. Many specimens with chromatophores on central region of scales, appearing as two or three rows of lines on lower half of flanks.

Dorsum of head black; also, premaxilla, maxilla, antorbital, infraorbitals 4, 5, and 6 and middle lower jaw with numerous black chromatophores. Most specimens with dark chromatophores on inner opercular surface, forming a spot.

Etymology. The specific epithet refers to the mythological Troya, in allusion to the name of the genus *Astyanax*, who was one of the sons of Hector, prince of Troya.

Distribution. *Astyanax troya* is known from the arroyos Cuñapirú Chico, Cuñapirú, and Tabay, in Misiones, Argentina. Only one specimen was found in the main course of the río Paraná, near Eldorado (Fig. 9).

DISCUSSION

The most complete systematic revision of the genus *Astyanax* was made many years ago by Eigenmann (1921, 1927). Subsequently, Géry (1977) followed that classification; therefore, a recent revision of the genus is still pendant.

Astyanax ojiara, discovered in the río Uruguay basin, northeast of Argentina, was the first described species of the genus having hooks on all fins of males (Azpelicueta & García, 2000). In this paper, *A. leonidas* and *A. troya*, other two species with the usually known hooks on the pectoral, pelvic, and anal fins, are described from the río Paraná basin. Both new species also have hooks on the caudal fin; besides, *A. troya* – as *A. ojiara* – has hooks on the dorsal fin of males which are absent on the same fin of *A. leonidas*.

The number of perforated scales in the lateral line and anal-fin rays of *A. leonidas* and *A. troya* ressemble those of *A. eigenmanniorum*. *Astyanax leonidas* differs from *A. eigenmanniorum* in the shape of premaxillary teeth, and the presence of very small hooks on caudal fin of males. *Astyanax troya* is differentiated from *A. eigenmanniorum* by the shape and number of dentary teeth, the shape of premaxillary teeth, and the hooks developed in all fin of males (Figs 2-8, 11-17 of present paper, and figure 7 of Azpelicueta & García, 2000).

Astyanax leonidas is distinguished from *A. ojiara* by the following features: the slender and deep maxillary tooth bears 3-4 cusps (vs. a very broad tooth with 7 cusps); the interorbital is narrower (26.9-30.4 vs. 31.0-35.6 % of HL); the anal-fin base is shorter (21.8-27.1 vs. 27.6-34.6 % of SL); the snout is shorter (20.3-25.0 vs. 24.5-30.9 % of HL), and the body depth is lower (30.2-35.3 vs. 34.0-40.0 % of SL).

Astyanax ojiara and *A. troya* share several features as dentary teeth decreasing in size anteroposteriorly, hooks on all fins of males, and also on pelvic axillary scale of large males. Nonetheless, *A. troya* has one pentacuspid maxillary tooth (vs. heptacuspid very broad), teeth of the inner premaxillary row scarcely expanded distally (vs. very expanded distally), relatively short anal-fin base (22.9-28.8 vs. 27.6-34.6 % of SL), and large eye (35.0-44.6 vs. 29.1-37.2 % of HL). As consequence of the large eye in *A. troya*, the snout, interobital distance, and postorbital length are comparatively smaller in this species than in *A. ojiara* (Table 2). Also, *A. troya* does not have sexual dimorphism in measurements such as that found in *A. ojiara*. Thus, the base of the dorsal fin is relatively shorter (12.4-14.9 vs. 13.8-17.2 % of SL), the caudal peduncle is longer (41.4-51.5 vs. 38.8-46.4 % of HL), and shallow (36.6-42.1 vs. 39.9-44.2 % of HL) in females of *A. troya* (See table 2). In males, the length of pelvic fin is scarcely shorter in *A. troya* than that present in *A. ojiara*. Also, the length of the maxilla is relatively longer in *A. troya* (21.2-26.6 vs. 21.0-24.5 % of HL in females; 21.0-27.6 vs. 22.0-25.4 % of HL in males) such as is the length of the snout plus maxilla (36.2-42.2 vs. 32.0-38.4 % of HL in females; 39.0-42.1 vs. 37.1-40.6 % of HL in males).

Astyanax leonidas is distinguished from *A. troya* by its robust body, with the dorsal profile slightly curved or straight, different from the ventral profile which is curved. *Astyanax troya* has a concave area very well marked at supraoccipital level, and both profiles are similarly curved or the dorsal profile of body is much curved.

The shape of the teeth in both new species is different. *Astyanax leonidas* presents a slender and long maxillary tooth whereas that tooth of *A. troya* is broad and low (Figs 4, 5). In *A. leonidas*, the premaxillary teeth of the inner row have the central cusp notably longer than the remaining ones and the lateral cusps originate at different levels whereas the central cusp of *A. troya* is scarcely longer and the remaining cusps arise at the same line (Figs 6, 7). The dentary teeth of *A. troya* are also broad –similar to those of premaxilla- and gradually decrease in size anteroposteriorly (Fig. 17). *Astyanax leonidas* has four large teeth, one median tooth and three or four very small ones (Fig. 8). The central cusp of those teeth is notably longer than the remaining ones. Also, the body is lower (30.2-35.3 vs. 33.0-40.9 % of SL).

Sexual dimorphism appear in many characids; hooks develop in different fins of males (Azpelicueta & García, 2000), but they have been reported in all fins of *A. ojiara* and *A. troya* only. Excluding the dorsal fin, hooks are present in all fins of *A. leonidas*. The specimens examined of *A. ojiara* were collected at the end of fall and most specimens, even those with small size, had fins plenty of hooks. Specimens of *A. leonidas* were collected in spring and the examined females were at the end of the spawning period; at that moment, the males had hooks well developed. *Astyanax troya* was captured in winter and spring and neither males nor females were mature, although ovaries were filled with oocites. In spite of the large size, few males of *A. troya* had well developed hooks.

Among characiforms, the contact between ectopterygoid and quadrate occurs in different degrees. Absence of overlapping between both bones may be observed in the figure 20, but the ectopterygoid reaches the quadrate in one specimen of *A. troya* whereas always overlaps in *A. leonidas* and *A. ojiara*. Also, the anterodorsal margin of quadrate and the anteroventral margin of metapterygoid of *A. troya* overlap in different lengths.

Posteriorly, the metapterygoid of *A. troya* has a ventral process, curved and directed anteriorly, suturing to the slender inner process of quadrate (Figs 20, 21), and a curved symplectic. The largest specimens of *A. ojiara* (71 mm SL) and *A. leonidas* (45.6 mm SL) have short metapterygoid process. Currently, both processes suture together via cartilage in many characiforms, and also in other large specimens of *Astyanax* examined (among others, *A. eigenmanniorum*, *A. asuncionensis*, and *A. alleni*, Azpelicueta, 1979) although the same suture is present in other species of *Astyanax* yet undescribed.

Astyanax ojiara, *A. leonidas*, and *A. troya* share a deep dentary (Figs 18, 19), and hooks on caudal fin. Also, *A. troya* and *A. ojiara* present hooks on dorsal fin and the pelvic axillary scale of large males. An encompassing study of the species presently included in the genus *Astyanax* will demonstrate if they constitute a natural group.

KEY FOR SPECIES OF *ASTYANAX* WITH HOOKS ON CAUDAL-FIN RAYS

1 Dorsal-fin rays of males with hooks, dorsal profile concave over supra-occipital area, dentary teeth decreasing in size gradually antero-posteriorly . . 2

- Dorsal-fin rays of males without hooks, dorsal profile straight or slightly curved, large dentary teeth followed by several small ones . . *A. leonidas*

2 Maxillary tooth broad, with five cusps; anal-fin base 22.9-28.8 % of SL, eye diameter 35.0-44.6 % of HL . . . . *A. troya*

- Maxillary tooth broader than deep, with seven small cusps; anal-fin base 27.6-34.6 % of SL, eye diameter 29.1-37.2 % of HL . . . . *A. ojiara*

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REFERENCES

ALMIRÓN, A. E., CASCIOTTA, J. R., AZPELICUETA, M. de las M. & CIONE, A. L. 2001. A new species of *Hypobrycon* (Characiformes: Characidae) from Uruguay basin in Misiones, Argentina. *Neotrópica* 47: 33-44.

AZPELICUETA, M. de las M. 1979. Anatomía comparada craneana y cintura pectoral de peces Characiformes. *Doctoral Thesis Nro. 372, Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata*, 100 pp.

AZPELICUETA, M. de las M. & GARCÍA, J. O. 2000. A new species of *Astyanax* (Characiformes, Characidae) from Uruguay river basin in Argentina, with remarks on hook presence in Characidae. *Revue suisse de Zoologie* 107: 245-257.

AZPELICUETA, M. de las M. & ALMIRÓN, A. E. 2001. A new species of *Bryconamericus* (Characiformes, Characidae) from Paraná basin in Misiones, Argentina. *Revue suisse de Zoologie* 108: 275-281.

CASCIOTTA, J. R., GOMEZ, S. E. & TORESANNI, N. I. 2000. *Gymnogeophagus che*, una nueva especie de la familia Cichlidae de la cuenca del Río Paraná (Perciformes, Labroidei). *Revista del Museo Argentino de Ciencias Naturales Bernardino Rivadavia, nueva serie* 2: 53-59.

EIGENMANN, C. H. 1921. The American Characidae. *Memoirs of the Museum of Comparative Zoology, Harvard University* 43: 209-310.

EIGENMANN, C. H. 1927. The American Characidae. *Memoirs of the Museum of Comparative Zoology, Harvard University* 43: 311-428.

GARUTTI, V. & BRITSKI, H. A. 2000. Descrição de uma espécie nova de *Astyanax* (Teleostei: Characidae) da bacia do alto rio Paraná e considerações sobre as demais espécies do gênero na bacia. *Comunicações do Museu de Ciências e Tecnologia da PUCRS, série Zoologia, Porto Alegre* 13: 65-88.

GÉRY, J. 1977. Characoids of the world. *T. F. H. Publications, Inc., Neptune City*, 672 pp.

TAYLOR, W. R. & VAN DYKE, G. C. 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. *Cybium* 9: 107-119.

REVUE SUISSE DE ZOOLOGIE 109 (2): 261-263; juin 2002

Zwei neue orientalische *Octavius* Fauvel (Coleoptera: Staphylinidae)
84. Beitrag zur Kenntnis der Euaesthetinen

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Two new oriental *Octavius* Fauvel (Coleoptera: Staphylinidae). - Two new Oriental species of the genus *Octavius* Fauvel are described: *Octavius squalidus* sp. n. (Sumatra), *O. insulindicus* sp. n. (Moluccas: Tanimbar Island; Sulawesi).

Key-words: Coleoptera - Staphylinidae - Euaesthetinae - *Octavius* - taxonomy - Orientalis.

EINLEITUNG

Die Gattung *Octavius* Fauvel ist weltweit verbreitet und besitzt in der orientalischen Region zahlreiche Vertreter, von denen aber bisher nur 29, vermutlich ein Bruchteil der tatsächlich vorhandenen, bekannt geworden ist (Puthz, 1977, 1980, 1985). In dieser Arbeit beschreibe ich zwei weitere Arten aus dieser Faunenregion, darunter den ersten Vertreter von den Molukken und Sulawesi.

Es gelten folgende Abkürzungen: dE = distance between eyes, Augenabstand; HT = Holotypus; lEl = greatest length of elytra, größte Elytrenlänge; lE = length of eyes, Augenlänge; lG: length of genae, Wangenlänge; lP = length of pronotum, Pronotumlänge; lS = length of suture, Nahtlänge; lT: length of temples, Schläfenlänge; PM = proportional measurements, Proportionsmaße (1 Einheit = 0.0085 mm); PT = Paratypus; wEl = greatest width of elytra, größte Elytrenbreite; wH = width of head, Kopfbreite; wP = width of pronotum, Halsschildbreite. – FMCh = Field Museum of Natural History, Chicago; MHNG = Muséum d'histoire naturelle de Genève.

SYSTEMATIK

Octavius insulindicus sp. n. Fig. 1, 2

Material: ♂-Holotyus und 1 ♀-Paratypus: Indonesien: Maluc F911216, Tanimbar Island: Yamdana Sanghiat Kramain (12), 16.IX.1991, litter, Agosti; 3 ♂♂, 6 ♀♀-Paratypen: SO Sulawesi, nr. Kalaka, 300 m, 20.V.1997, Kurbatov (HT und PTT im MHNG, PTT auch in coll.m.).

Beschreibung: Länge 1,1-1,3 mm (Vorderkörperlänge: 0,65 mm). Makrophthalm, geflügelt, rötlichbraun, mäßig glänzend, Vorderkörper mäßig fein und dicht

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Manuskript angenommen 19.12.2001

punktiert sowie genetzt, Abdomen fein und dicht punktiert und genetzt; Beborstung dicht, anliegend. Fühler, Kiefertaster und Beine gelblich.

PM des HT: wH: 27, dE: 23,5; lE: 6,5; lT: 7,5; lG: 4; wP: 25; lP: 25,5; wEl: 29; lEl: 28; lS: 23.

Männchen: 8. Sternit (Fig. 2), asymmetrisch, Apikalausschnitt im hinteren Sechstel. 9. Sternit apikal häutig gesäumt, mit winzigem Medianvorsprung. Aedoeagus (Fig. 1) dem des *O. biroi* Puthz sehr ähnlich (vgl. Abb. 14, Puthz, 1977), die Spitze des Medianlobus jedoch anders geformt, die Parameren mit 8 apikalen Borsten.

Kopf etwas schmäler als die Elytren, Augen fein facettiert, deutlich etwas kürzer als die Schläfen, kaum aus der Seitenkontur des Kopfes vorragend; Punktierung wenig fein, deutlich, sehr dicht, in der hinteren Stirnmitte feiner und weitläufiger, die vordere Stirnpartie zwischen den Fühlerhöckern nur eng und tief genetzt. Fühler kurz mit abgesetzter, zweigliedriger Keule. Pronotum kaum länger als breit, mit deutlicher, vorn und hinten breit abgekürzter Mittelfurche; Punktierung seitlich ähnlich wie auf der Stirn, zur Mitte flacher und in der dichten Mikroskulptur erlöschend. Elytren quadratisch, gut so breit wie lang, Punktierung weniger dicht als auf dem Pronotum, weshalb die Elytren einen etwas stärkeren Glanz zeigen. Abdomen dicht und fein, körnig punktiert, 7. Tergit mit deutlichem apikalem Hautsaum.

Bemerkungen: *Octavius insulindicus* sp. n. ist die Schwesterart des aus Neuguinea beschriebenen *O. biroi* Puthz; sie repräsentiert die erste von den Molukken bekannt gewordene Spezies der Gattung. Von *O. biroi* unterscheidet sie sich, abgesehen von ihren männlichen Sexualcharakteren, durch geringere Größe, kleinere und flachere Augen, deutlichere Pronotumpunktierung und eher ovalen (als herzförmigen) Pronotumumriss.

Octavius squalidus sp. n. Fig. 3, 4

Material: ♂-Holotypus: Sumatra. Aceh, Mt. Leuser N. P., 300-500 m, Ketambe, 29.-30.XI.1989, Agosti, Burckhardt & Löbl # 25a (im MHNG).

Beschreibung: Länge: 1,5-1,7 mm (Vorderkörperlänge: 0,8 mm). Makrophthalm, brachypter, rötlichbraun, ziemlich glänzend (wenn sauber!), Kopf grob und gedrängt-dicht skulptiert, Pronotum und Elytren mit körniger Skulptur, Elytren mit zwei Längsrippen, Abdomen sehr fein und mäßig dicht, körnig punktiert; Beborstung kurz, anliegend. Fühler, Kiefertaster und Beine gelblich.

PM des HT: wH: 45; dE: 10,5; lE: 10,5; lT: 8; lG: 6; wP: 56; lP: 37; wEl: 60; lEl: 35; lS: 25.

Männchen: 8. Sternit (Fig. 3), symmetrisch, Apikalausrandung etwa im hinteren Zehntel. 9. Sternit apkal stark zugespitzt. Aedoeagus (Fig. 4) im Umriss an den des *O. flavescens* (Kistner) erinnernd, im Innern jedoch mit kräftigen Dornen; Parameren mit 4 apikalen Borsten.

· *Bemerkungen*: Diese neue Art gehört zu denjenigen mit hinten stark eingeschnürtem Pronotum und breiten, längsrippentragenden Elyten („*Turellus*-Typ"). Äußerlich ähnelt sie ihren Nahverwandten so stark, dass eine eindeutige Identifizierung meist nur mit Hilfe des Aedoeagus möglich sein dürfte. Von *O. flavescens* unterscheidet sie sich durch robusteren Bau, erheblich kürzere Elytren und gröbere,

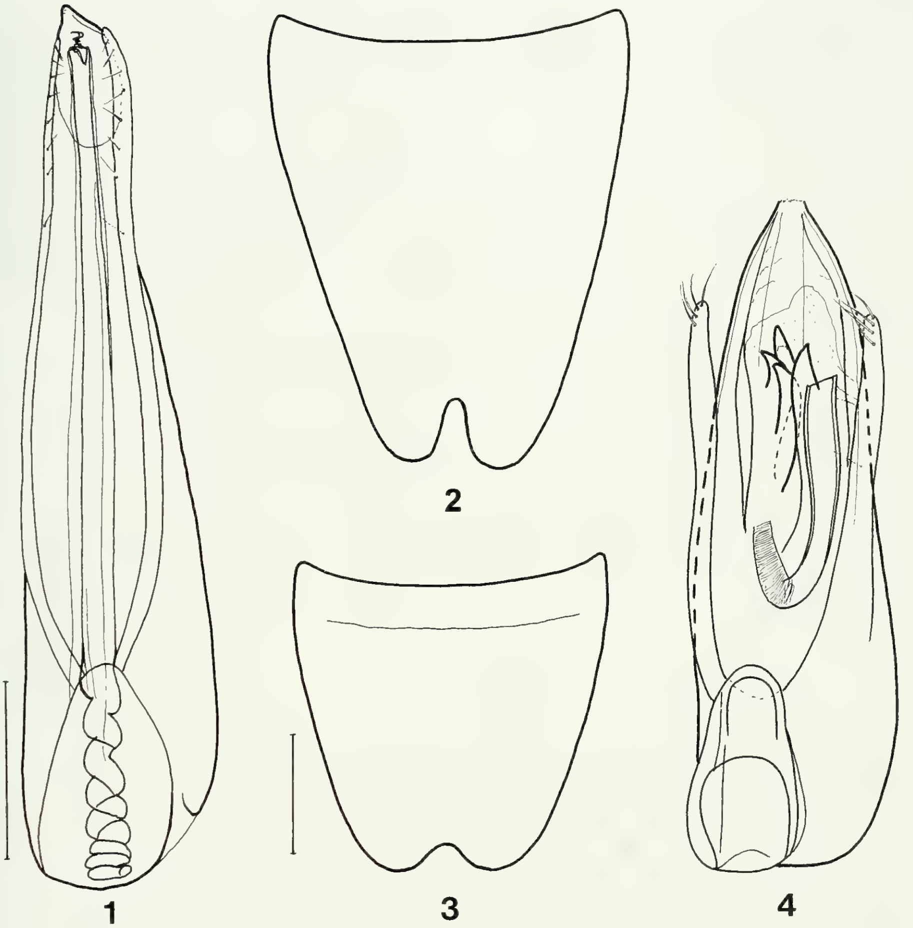

FIG. 1-4

Dorsalansicht des Aedoeagus (1, 4) und 8. Sternit der Männchen von *Octavius insulindicus* sp. n. (HT: 1, 2) und *O. squalidus* sp. n. (HT: 3, 4). Maßstab = 0,1 mm (gleicher Maßstab für Figuren 1, 2, 4).

zumindest auf den Elytren weitläufigere Skulptur, von den übrigen Arten (vgl. auch die Tabelle bei Puthz, 1985) durch ihre Maße (vor allem auch die Augenlänge) und den Aedoeagus.

LITERATUR

PUTHZ, V. 1977. Die Gattung *Octavius* Fauvel (Coleoptera: Staphylinidae) weltweit verbreitet ! *Opuscula zoologica, Budapest* 14:105-126.

PUTHZ, V. 1980. Über einige orientalische *Octavius*- Arten (Coleoptera, Staphylinidae) 34. Beitrag zur Kenntnis der Euaesthetinen. *Revue suisse de Zoologie* 87: 749-751.

PUTHZ, V. 1985. Neue *Octavius* aus Nordindien und aus dem Himalaya-Gebiet (Coleoptera, Staphylinidae) 47. Beitrag zur Kenntnis der Euaesthetinen. *Revue suisse de Zoologie* 92: 697-705.

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New addition to the scorpion fauna (Arachnida: Scorpiones) of Sri Lanka*

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New addition to the scorpion fauna (Arachnida: Scorpiones) of Sri Lanka. - In this paper we present results of the study of a collection of scorpions from Sri Lanka, now deposited in the Natural History Museum, Geneva. This collection comprises 3 families, 3 genera and 7 species. A new species *Isometrus (Reddyanus) garyi* sp. n. and a new subspecies *Isometrus (Isometrus) thwaitesi pallidus* ssp. n. (Buthidae) are described. *Isometrus (Reddyanus) loebli* Vachon and *Heterometrus (Gigantometrus) swammerdami titanicus* Couzijn are raised to species rank.

Key-words: scorpion - Sri Lanka - new species - new subspecies - *Isometrus*.

INTRODUCTION

Studies on the scorpions of Sri Lanka, formerly Ceylon, began in the second half of the 19th century but, in most cases, these are isolated descriptions (Karsch, 1879, 1891; Pocock, 1894, 1897, 1899; Kraepelin, 1913). The first comprehensive study of the scorpions of India and Ceylon, which also included Burma, was published by Pocock (1900). Subsequently, other contributions to the knowledge of the fauna of the region have been made, but they are mainly concerned with India (Sreenivasa-Reddy, 1970; Tikader & Bastawade, 1983). Vachon (1982) made a specific study on the scorpions of Sri Lanka, in which, however, he left several species undetermined. Doubts concerning the species of *Lychas* actually present in Sri Lanka have recently been clarified (Lourenço, 1997; Lourenço & Huber, 1999). The status of certain species of the genus *Isometrus*, nevertheless remained unclear.

Among the additions to our knowledge of the scorpion fauna of Sri Lanka discussed in the present paper, one new species and one new subspecies of *Isometrus* are described. The exact composition of the genus *Isometrus* worldwide is not yet known precisely. Sissom (1990) indicated a total of 15 species for the two recognized sub-genera. In their Catalog of the Scorpions of the World, Fet & Lowe (2000) listed 20 congeneric species, one of them with two subspecies. New species were described by Kovarik (1994, 1997, 1998), but these require confirmation. Most authors agree

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that the taxonomy of the genus *Isometrus* remains confused (Fet & Lowe, 2000), even though the status of certain species has recently been clarified. All the specimens studied here are deposited in the collections of the Muséum d'histoire naturelle, Geneva.

BUTHIDAE C. L. Koch, 1837

Isometrus Ehrenberg, 1828

Isometrus (Isometrus) maculatus (DeGeer, 1778)

Material examined: SRI LANKA: Anuradhapura District, Padaviya, antiquities site, 20-23/VII/1978 (K.V. Krombein, T. Wijesinhe, L. Jayawickrema, V. Kulaselare), 1 female; Padaviya Tank, 70 m, 11-14/X/1977 (K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, M. Jayaweera), 1 female; Wildlife Soc. Bungalow, Hunuwilagama, Wilpattu, 10-19/III/1970, 200 ft (Davis & Rowe)?; Mannar District, 0.5 Mi NE Kokmottre Wilpattu National Park, 15-16/II/1979 (K.V. Krombein, T. Wijesinhe, S. Siriwardane, T. Gunawardane), 1 female, 13 juveniles; Matale District, Sigiwiya, 17/VI/1971 (W. Messersmith), 1 female; Marichchikaddy, 27/XI/1974 (H. Prassana & Farook), 1 female; Uggal Kalkota, East coast, 15/II/1971 (P.O. Karunaratne), 1 male.

Note: *Isometrus maculatus* is the most widely distributed scorpion in the world. Its distribution has anthropogenical background, probably going back to the great naval voyages of the 16th century. *I. maculatus* is found in most tropical and subtropical coastal regions of the world. The question remains, however: What is the original area of distribution of this species? We suggest here that it could be Sri Lanka. This is the only region in the world where *I. maculatus* is found in really wild conditions inland.

Isometrus (Isometrus) thwaitesi pallidus ssp. n. Figs 1-7

Type material: 1 female holotype, SRI LANKA: Mannar District, Wilpattu National Park, O.5 Mi. NE Cockmuttai, 20m, 6-7/X/1977 (K.V. Krombein, P.B. Karunaratne, T. Wijesinhe & M. Jayaweera).

Etymology: The name makes reference to the very pale coloration of this subspecies.

Diagnosis: The new sub-species can be distinguished from *Isometrus (Isometrus) thwaitesi* Pocock by the following characters:

- Coloration: The new species is generally of a paler yellow; chela and vesicle are yellowish with pale brownish spots, whereas in *I. (I.) thwaitesi thwaitesi* they are black with yellow spots.
- Pectinal teeth counts in the new sub-species show a smaller number of teeth than in specimens of *I.(I.) thwaitesi thwaitesi* (see Vachon, 1982), and the basal middle lamella is less dilated.

Description based on female holotype:

Morphometric measurements (in mm). Total length 37,0; Carapace: length 3.9, anterior width 2.8, posterior width 3.9; Metasomal segment I: length 2.8, width 1.8; Metasomal segment V: length 5.2, width 1.4, depth 1.5; Vesicle: width 1.3, depth 1.3; Pedipalp: Femur length 3.8, width 1.1; Tibia length 4.5, width 1.7; Chela length 7.0, width 1.4, depth 1.3; Movable finger: length 5.0.

Coloration. Generally pale yellow with several variegated spots or pigmented zones on the body and its appendages. Prosoma: carapace yellowish with variegated spots; eyes surrounded by black pigment. Mesosoma: yellowish with 3 longitudinal dark stripes. Metasoma: all segments yellowish with pale brown variegated spots. Vesicle yellowish with pale brown spots; aculeus yellowish at the base and reddish at its extremity. Venter pale yellow. Chelicerae yellowish with brownish variegated spots; teeth reddish. Pedipalps: yellowish throughout, with pale brown variegated spots; rows of granules on dentate margins of the fingers reddish. Legs yellow with pale brown variegated spots.

Morphology. Prosoma: Anterior margin of carapace moderately emarginate. Carapace carinae moderately developed; central median and posterior median carinae moderately developed; anterior median carinae, central lateral and central median carinae moderately developed; posterior median carinae weak. Intercarinal spaces weakly granular, almost smooth centrally. Median ocular tubercle anterior to the center of the carapace; median eyes separated by 1.5 ocular diameters. Three pairs of lateral eyes. Mesosoma: tergites I-VI with a median carinae, weak on I, moderately developed on II-VI. Tergite VII pentacarinate, with lateral pairs of carinae moderate to strong; median carinae present in proximal half, moderately developed. Intercarinal spaces moderately granular. Sternites almost smooth. Pectines moderately long; pectinal teeth count 13-14. Metasoma: Segment I with 10 keels, crenulate; II-IV with 8 keels. Dorsolateral carinae moderately developed. Segment V with 5 keels. Dorsal furrows of all segments weakly developed, smooth; intercarinal spaces weakly granular. Telson weakly granular, with one lateral carina; subaculear tubercle strong and spinoid. Chelicerae with dentition characteristic of buthids (see Vachon, 1963). Pedipalps: Trichobothrial pattern orthobothriotaxic, type A (see Vachon, 1974); dorsal trichobothria of femur in Beta configuration (see Vachon, 1975). Femur pentacarinate; all carinae moderately crenulate. Tibia with 7 keels; all carinae weakly to moderately developed; dorsointernal carinae with 4 spinoid granules. Chelae slender, with elongated fingers; all carinae weakly granular. Dentate margins on movable and fixed fingers composed of 7 linear rows of granules. Legs: Ventral aspect of tarsi with a brush-like group of setae. Tibial spurs absent; pedal spurs present and moderately developed on legs III-IV.

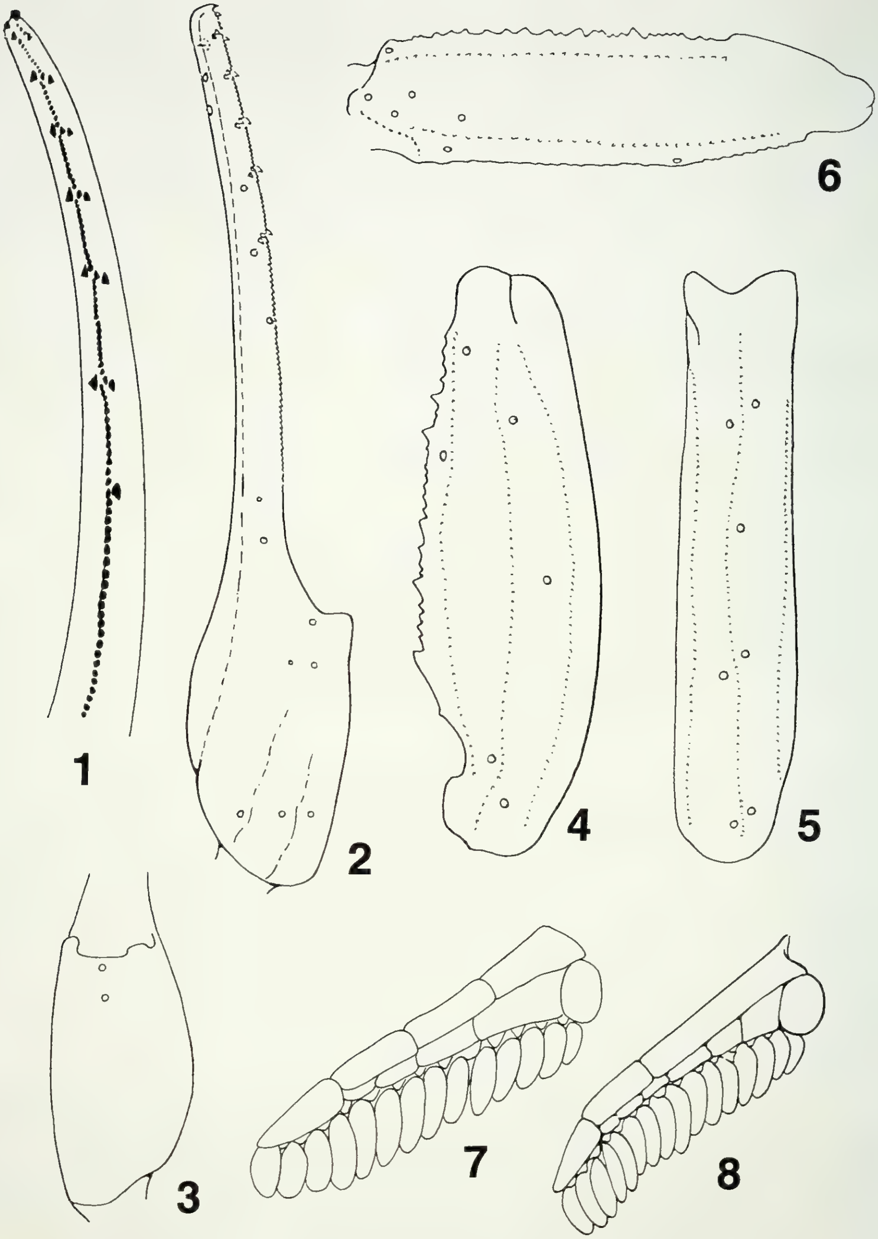
Isometrus (Reddyanus) besucheti Vachon, 1982

Material examined: SRI LANKA: Anuradhapura District, NW Coast of Nuwara Wewa, under a stack of bricks in a dry area, 14/II/2000 (D. Huber), 3 females; Galle District, Kanneliya, Sinharaja Forest Reserve, 24-26/I/1979 (K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, S. Siriwardane, T. Gunawardane), 1 female. Polonnaruwa District, Minneriya to Habarana, Minneriya Giritale Sanctuary, under bark of rotten tree, dry jungle vegetation, 18/II/2000 (D. Huber); 1 male, 1 juvenile male, 2 females.

Isometrus (Reddyanus) loebli Vachon, 1982, stat. n.

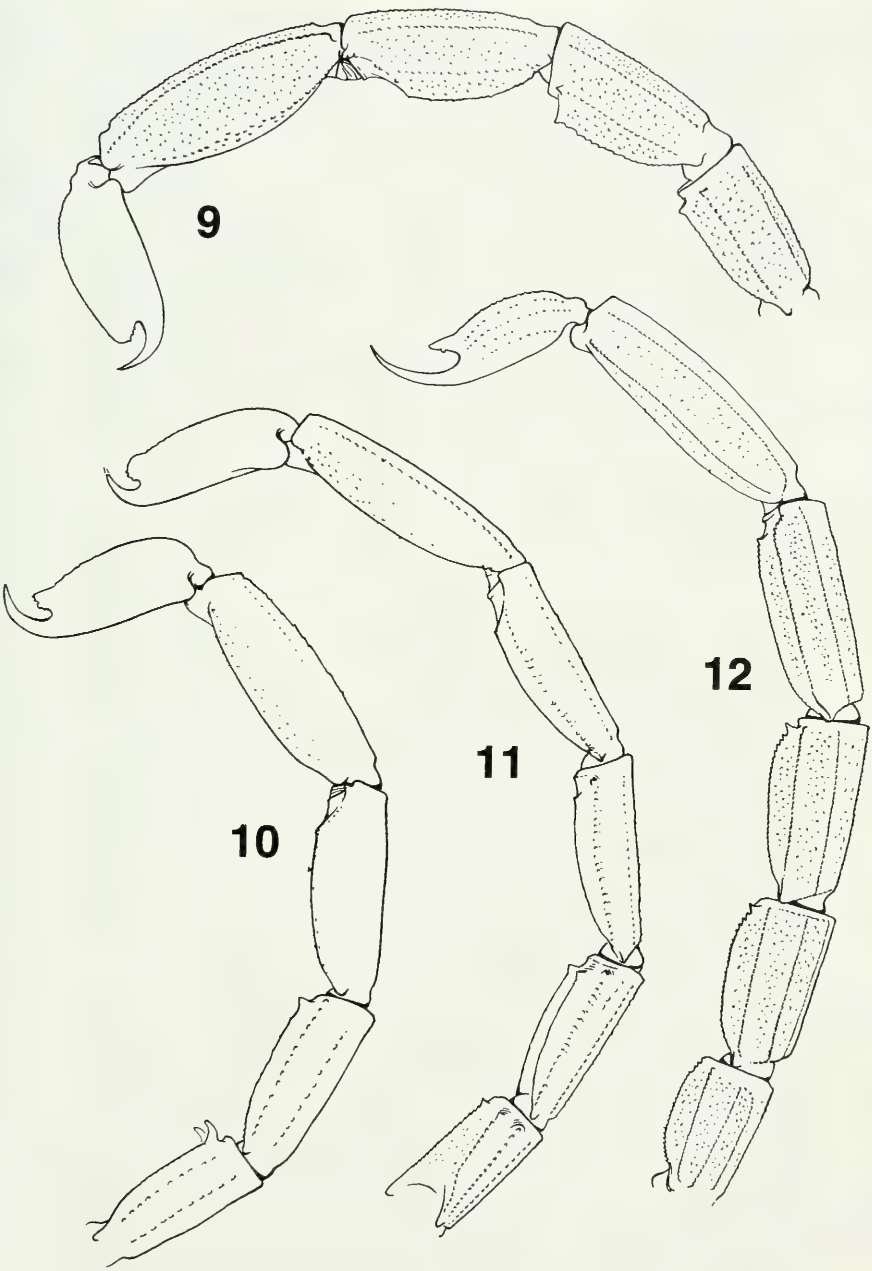
Material examined: SRI LANKA: Anuradhapura District, Irrigation Bungalow, Padaviya, 180ft, 27/II-9/III/1970 (Davis & Rowe), 1 male, 2 females, 1 male juvenile.

Note: Vachon (1982) defined this form as a subspecies of *I. (R.) acanthurus* Pocock, which only occurs in India. The form in Sri Lanka possesses two strong



FIGS 1-8

1-7. *Isometrus (Isometrus) thwaitesi pallidus* ssp. n. (female holotype). 1. Disposition of granulations on the dentate margins of the pedipalp-chela movable finger. 2-6. Trichobothrial pattern. 2-3. Chela, dorso-external and ventral aspects. 4-5. Tibia, dorsal and external aspects. 6. Femur, dorsal aspect. 7. Pecten. 8. Idem for *Isometrus (Isometrus) thwaitesi thwaitesi* (female).



FIGS 9-12

Metasoma and telson, lateral aspect. 9. *Isometrus (Reddyanus) besucheti* (male). 10. *Isometrus (Reddyanus) loebli* (male). 11. *Isometrus (Reddyanus) basilicus* (male). 12. *Isometrus (Isometrus) thwaitesi thwaitesi* (female) (from Vachon, 1982).

spines on the dorsal carinae of only metasomal segment II, whereas in the Indian form these spines are also present on segment III. Taking into account this important difference and also the insular isolation of the Sri Lanka form, we raise it to specific rank.

Isometrus (Reddyanus) garyi sp. n. Figs 13-18

Type material: SRI LANKA: 1 juvenile female (holotype), 1 juvenile male (paratype), Mannar District, beside an irrigation canal, Madhu Road, 50 ft. 23/III/1970 (Davis & Rowe).

Etymology: The specific name is in honor of Gary Polis, in recognition of his contribution to scorpion ecology.

Diagnosis: The new species is close to *Isometrus (R.) besucheti* Vachon, but is distinguishable from this species by the following characters: (i) coloration: generally yellowish; carapace heavily spotted with brown; tergites with 3 longitudinal brown stripes; metasomal segments spotted only in their distal portions, except for a completely totally brown segment V. Pedipalp tibia spotted with brown; chela hand yellow, fingers brown. In contrast *I. (R.) besucheti* is yellowish and variegated with brown spots throughout, (ii) pectinal teeth counts in the new species show a lower number of teeth (15-15) in the juvenile male examined than in the male specimens of *I. (R.) besucheti* (17-18; see Vachon, 1982), (iii) the subaculear tubercle in the new species is spinoid, whereas in *I. (R.) besucheti* it is stronger and rhomboid.

Description based on female holotype:

Morphometric measurements (in mm). Total length 28,0; Carapace: length 2.4, anterior width 2.0, posterior width 2.8; Metasomal segment I: length 1.3, width 1.4; Metasomal segment V: length 2.7, width 1.3, depth 1.3; Vesicle: width 1.0, depth 1.0; Pedipalp: Femur length 2.0, width 0.8, Tibia length 2.2, width 1.2, Chela length 3.9, width 1.1, depth 0.8; Movable finger: length 2.7.

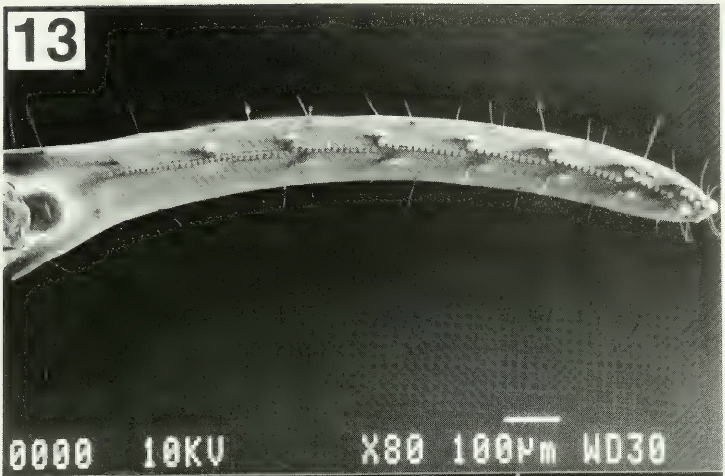
Coloration. Generally yellow with several spots or pigmented zones on the body and its appendages. Prosoma: carapace yellowish, heavily spotted with brown; eyes surrounded by black pigment. Mesosoma: yellowish with 3 longitudinal brownish stripes. Metasoma: segments I-IV yellowish with a brown ring at posterior end; segment V brownish, vesicle yellowish; aculeus yellowish at the base and reddish at the extremity. Venter pale yellow. Chelicerae yellowish with variegated brown spots; teeth reddish. Pedipalps: yellowish throughout; femur and tibia with large brown spots dorsally; hand of chela yellow, fingers blackish brown. Legs yellowish with widely spaced dark spots.

Morphology. Prosoma: Anterior margin of carapace weakly to moderately emarginate. All carapace carinae weakly developed; central median, posterior median, anterior median, central lateral and central median carinae weak. Intercarinal spaces weakly granular, almost smooth. Median ocular tubercle anterior to the center of the

FIGS 13-15

Isometrus (Reddyanus) garyi sp. n. (male paratype). 13. Disposition of granulations on the dentate margins of the pedipalp-chela movable finger. 14. Details on the tip of the movable finger. 15. Metasomal segment V and telson, lateral aspect.

13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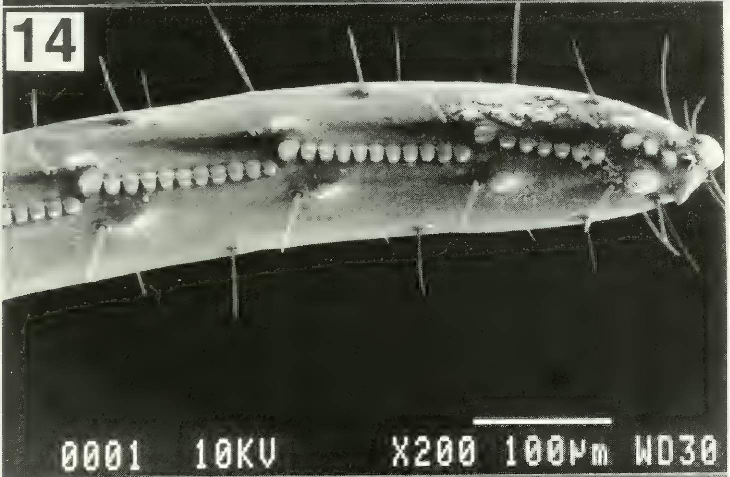
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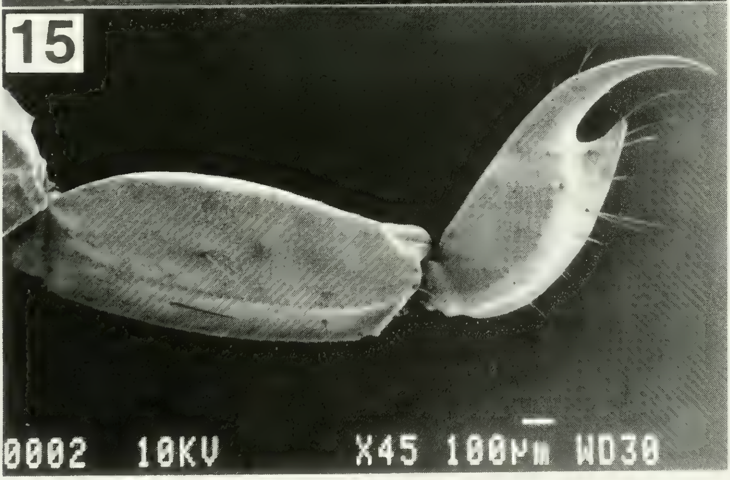
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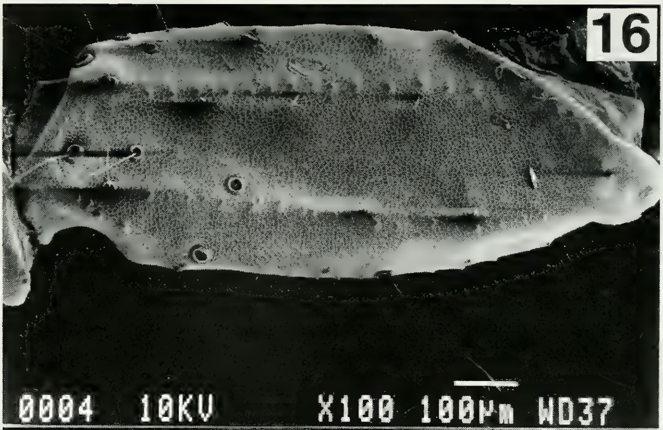
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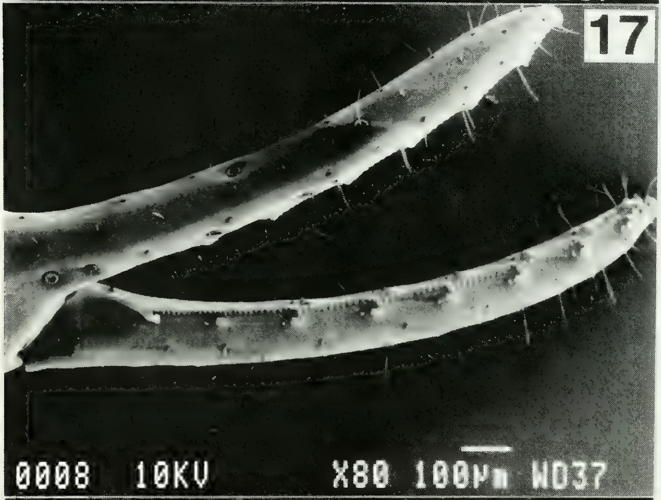
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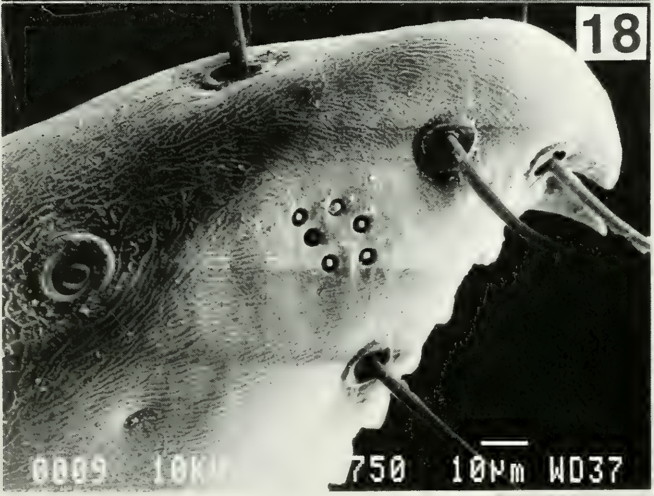
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carapace; median eyes separated by 1.5 ocular diameters. Three pairs of lateral eyes. Mesosoma: Tergites I-VI with a median carina, weak on I, moderate on II-VI. Tergite VII pentacarinate, with lateral pairs of moderately developed carinae; median carinae present in proximal half, moderately developed. Intercarinal spaces weakly granular. Sternites smooth. Pectines moderately long; pectinal teeth count 15-14 (male 15-15). Metasoma: Segment I with 10 keels, crenulate; II-IV with 8 keels. Dorsolateral carinae moderate to strong, terminating distally in an enlarged denticle, most pronounced on II-III. Segment V with 5 keels; ventromedian carinae weak. Dorsal furrows of all segments moderately developed, smooth; intercarinal spaces weakly granular. Telson weakly granular. Subaculear tubercle strong and rhomboid. Chelicerae with dentition characteristic of buthids (see Vachon, 1963). Pedipalps: trichobothrial pattern orthobothriotaxic, type A (see Vachon, 1974); dorsal trichobothria of femur in Beta configuration (see Vachon, 1975). Femur pentacarinate; all carinae moderately crenulate. Tibia with 7 keels; all carinae weak to moderately developed; dorsointernal carinae with some weak spinoid granules. Chelae short, with moderately elongated fingers; all carinae weakly granular. Dentate margins on movable and fixed fingers composed of 6-7 linear rows of granules. Legs: Ventral aspect of tarsi with a brush-like group of setae. Tibial spurs absent; pedal spurs present and moderately developed on legs III-IV.

CHAERILIDAE Pocock, 1893

Chaerilus Simon, 1877

Chaerilus ceylonensis Pocock, 1894

Material examined: SRI LANKA : Ciretale, 9/III/1992 (N. Haug), 1 female pre-adult.

SCORPIONIDAE Latreille, 1802

Heterometrus Ehrenberg, 1828

Heterometrus (Gigantometrus) titanicus Couzijn, 1981, stat. n.

Material examined: SRI LANKA: Anuradhapura District, Padaviya, antiquities site, 20-23/VII/1978 (K.V. Krombein, T. Wijesinhe, L. Jayawickrema V. Kulasekare), 1 male. Hambantota District, Palutapana, 10-12/VIII/1972 (K.V. Krombein, P.B. Karunaratne), 1 male, pre-adult. Kandy District, Udawahekele, Sanctuary Kandy, 6-8/VI/1978 (K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, V. Kulasekane, L. Jayawickrema), 2 males. Matale District, Dumbulla-Kandy Road, night-sed, 12/X/1973 (M.& B. Robinson), 1 female pre-adult. Ratnapura District, Panamure, 500m, 15-21/X/1970 (O.S. Flint Jr.), 1 male, juvenile.

Note: This form was originally described as a sub-species of *Heterometrus (Gigantometrus) swammerdami* (Simon, 1872) which lives exclusively in India. Taking into account the morphological differences proposed by Couzijn (1981), and the insular isolation of this population, we raise *H. (G.) titanicus* to specific rank.

FIGS 16-18

Isometrus (Reddyanus) garyi sp. n. (male paratype). 16. Femur, dorsal aspect, showing internal, external and dorsal trichobothria; note the Beta configuration for dorsal. 17. Fixed and movable fingers of pedipalp chela; note trichobothria. 18. Detail of the tip of the pedipalp chela fixed finger.

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REFERENCES

COUZIJN, H. W. C. 1981. Revision of the genus *Heterometrus* Hemprich & Ehrenberg (Scorpionidae, Arachnidea. *Zoologische verhandelingen* 184: 1-196.

FET, V. & LOWE, G. 2000. Family Buthidae C. L. Koch, 1837. *In*: FET, V., SISSOM, W. D., LOWE, G. & BRAUNWALDER, M. E. (eds). Catalog of the Scorpions of the World (1758-1998). *New York, NY: The New York Entomol. Society*: 54-286.

KARSCH, F. 1879. Scorpionologische Beiträge. Part I. *Mitteilungen des Münchener entomologischen Vereins* 3: 6-22.

KARSCH, F. 1891. Arachniden von Ceylon und von Minikoy gesammelt von den Herren Doctoren P. und F. Sarasin. *Berliner entomologische Zeitschrift* 36(2): 267-310.

KOVARIK, F. 1994. *Scorpiops irenae* sp. n. from Nepal and *Scorpiops hardwickei jendeki* subsp. n. from Yunnan, China (Arachnida: Scorpionida: Vaejovidae). *Acta Societatis Zoologicae Bohemoslovenicae* 58: 61-66.

KOVARIK, F. 1997. *Isometrus (Reddyanus kurkai* sp. n. from Indonesia (Scorpiones, Buthidae). *Casopis Narodniho muzea Rada prirodovedna* 166 (1-4): 5-10.

KOVARIK, F. 1998. *Isometrus (Reddyanus) krasenskyi* sp. n. from Indonesia and *I.(R.) navaiae* sp. n. from the Philippines (Scorpiones: Buthidae). *Acta Societatis Zoologicae Bohemoslovenicae* 62: 35-40.

KRAEPELIN, K. 1913. Neue Beiträge zur Systematik der Gliederspinnen. III. A. Bemerkungen zur Skorpionenfauna Indiens. B. Die Skorpione, Pedipalpen und Solifugen Deutsch-Ost-Afrikas. *Mitteilungen aus dem Naturhistorischen Museum* (2. *Beiheft zum Jahrbuch der Hamburgischen wissenschaftlichen Anstalten*, 1912) 30: 123-196.

LOURENÇO, W. R. 1997. A new species of *Lychas* Koch, 1845 (Chelicerata, Scorpiones, Buthidae) from Sri Lanka. *Revue suisse de Zoologie* 104 (4): 831-836.

LOURENÇO, W. R. & HUBER, D. 1999. Another new species of *Lychas* Koch, 1845 (Chelicerata, Scorpiones, Buthidae) from Sri Lanka. *Entomologische Mitteilungen aus dem Zoologischen Museum Hamburg* 13 (159): 23-27.

POCOCK, R. I. 1894. A small contribution to our knowledge of the scorpions of India. *Annals and Magazine of Natural History* (6), 13: 72-84.

POCOCK, R. I. 1897. Descriptions of some new species of scorpions from India. *Journal of the Bombay Natural History Society* 11: 102-117.

POCOCK, R. I. 1899. Descriptions of six new species of scorpions from India. *Journal of the Bombay Natural History Society* 12: 262-268.

POCOCK, R. I. 1900. Arachnida. *In*: BLANDFORD, W. T. (ed.). The Fauna of British India, including Ceylon and Burma. *London*, xii + 279 pp.

SISSOM, W. D. 1990. Systematics, biogeography, and paleontology. *In*: POLIS, G. A. (ed.). The biology of scorpions. *Stanford, CA: Stanford University Press*: 64-160.

SREENIVASA-REDDY, R. P. 1970. The systematic position of the scorpion genus *Charmus*. *Journal of the Natural History* 4: 17-23.

TIKADER, B. K. & BASTAWADE, D. B. 1983. The Fauna of India. Vol. 3. Scorpions (Scorpionida: Arachnida). *Zoological Survey of India, Calcutta*, 671 pp.

VACHON, M. 1963. De l'utilité, en systématique, d'une nomenclature des dents des chélicères chez les Scorpions. *Bulletin du Muséum National d'Histoire naturelle, Paris 2è sér.* 35 (2): 161-166.

VACHON, M. 1974. Etude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en arachnologie. Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum National d'Histoire naturelle, Paris, 3è sér.*, n° 140, Zool. 104: 857-958.

VACHON, M. 1975. Sur l'utilisation de la trichobothriotaxie du bras des pédipalpes des Scorpions (Arachnides) dans le classement des genres de la famille des Buthidae Simon. *Comptes Rendus des Séances de l'Académie de Sciences*, Paris, sér. D, 281: 1597-1599.

VACHON, M. 1982. Les scorpions de Sri Lanka (Recherches sur les scorpions appartenant ou déposés au Muséum d'Histoire naturelle de Genève III). *Revue suisse de Zoologie* 89 (1): 77-114.

REVUE SUISSE DE ZOOLOGIE 109 (2): 277-294; juin 2002

Two new Neotropical species of *Bucculatrix* leaf miners (Lepidoptera: Bucculatricidae) reared from *Cordia* (Boraginaceae)

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Two new Neotropical species of *Bucculatrix* leaf miners (Lepidoptera: Bucculatricidae) reared from *Cordia* (Boraginaceae). - Two new species of *Bucculatrix*, each initially mining and later externally skeletonizing the leaves of two different Neotropical species of *Cordia* (Boraginaceae), are described and illustrated. *Bucculatrix caribbea* Davis & Landry, sp. n. was reared from the leaves of *Cordia sebestena* L. on Glovers Reef, Belize and Cozumel, Mexico. The biology of this species is briefly summarized and all primary stages, except that of the egg, are illustrated. The adult of *Bucculatrix cordiaella* Davis & Landry, sp. n. is described from six islands of the Galápagos archipelago. This represents the first record for Bucculatricidae from the Galápagos. The larva feeds on the leaves of *Cordia lutea* Lam. Both species are morphologically allied to *Bucculatrix ilecella* Busck, a leaf miner on *Ilex* sp. from southern Texas, USA.

Key-words: larva - leaf mining - hypermetamorphosis - pupa - Belize - Mexico - Galápagos Islands.

INTRODUCTION

Because of their typically small size and rich diversity, leaf-mining Lepidoptera are among the poorest known groups of Lepidoptera. The larvae of some plant-mining families are particularly interesting in that they undergo hypermetamorphic development, with certain instars exhibiting not only distinctly different morphology but also divergent biology. Hypermetamorphosis is especially prevalent in the large family Gracillariidae (Needham *et al.,* 1928; Kumata, 1978; Davis, 1987; Davis & Robinson, 1999; Wagner *et al.*, 2000). It also has been reported in Bucculatricidae (Braun, 1963), Opostegidae (Davis, 1989), as well as in the ectoparasitic family Epipyropidae (Davis, 1987). Larval hypermetamorphosis in *Bucculatrix* is particularly

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evident between the leaf-mining instars and the later externally feeding instars. For example, instars 3-4 of *Bucculatrix caribbea* possess thoracic legs but lack prolegs and possess more depressed bodies; whereas the body of the last two instars is cylindrical with five pairs of well developed prolegs, and a head possessing generally longer cranial setae and a more shallow epicranial notch. The first two mining instars are believed to be apodal.

The predominantly leaf-mining family Bucculatricidae currently includes about 250 species worldwide (Davis & Robinson, 1999). In the New World the Bucculatricidae are represented only by the genus *Bucculatrix* which includes 104 described species, of which only four have been described from the Neotropical region (Davis, 1983; Davis & Miller, 1984; Rubinoff & Osborne, 1997). A recent outbreak of a species of *Bucculatrix* on *Cordia lutea* Lam. in the Galápagos Islands has necessitated a study of that insect, as well as that of another closely related leaf miner on *Cordia sebestena* L. from the western Caribbean region. Both species appear closely allied to *Bucculatrix ilecella* Busck, a species reared from a deciduous holly (*Ilex* sp.) from southern Texas, USA. Braun (1963) recognized *B. ilecella* as the sole member of her section VII, which was characterized in part by the male valva divided nearly its entire length, broad vinculum, and unusual female signa, consisting of a series of radiating, dentate rods extending part way into the ductus bursae. Descriptions of both previously undescribed species are presented herein, including a brief discussion of the pupa and hypermetamorphic larva of *B. caribbea*.

The following abbreviations are used: BL, Bernard Landry; BMNH, The Natural History Museum, London, England; CDRS, Charles Darwin Research Station, Santa Cruz Island, Galápagos, Ecuador; CNC, Canadian National Collection of Insects, Ottawa, Ontario, Canada; DLW, David L. Wagner; DRD, Donald R. Davis; LR, Lazaro Roque-Albelo; MHNG, Muséum d'histoire naturelle, Geneva, Switzerland; USNM, National Museum of Natural History, Washington, D.C., U.S.A.

TAXONOMIC TREATMENT

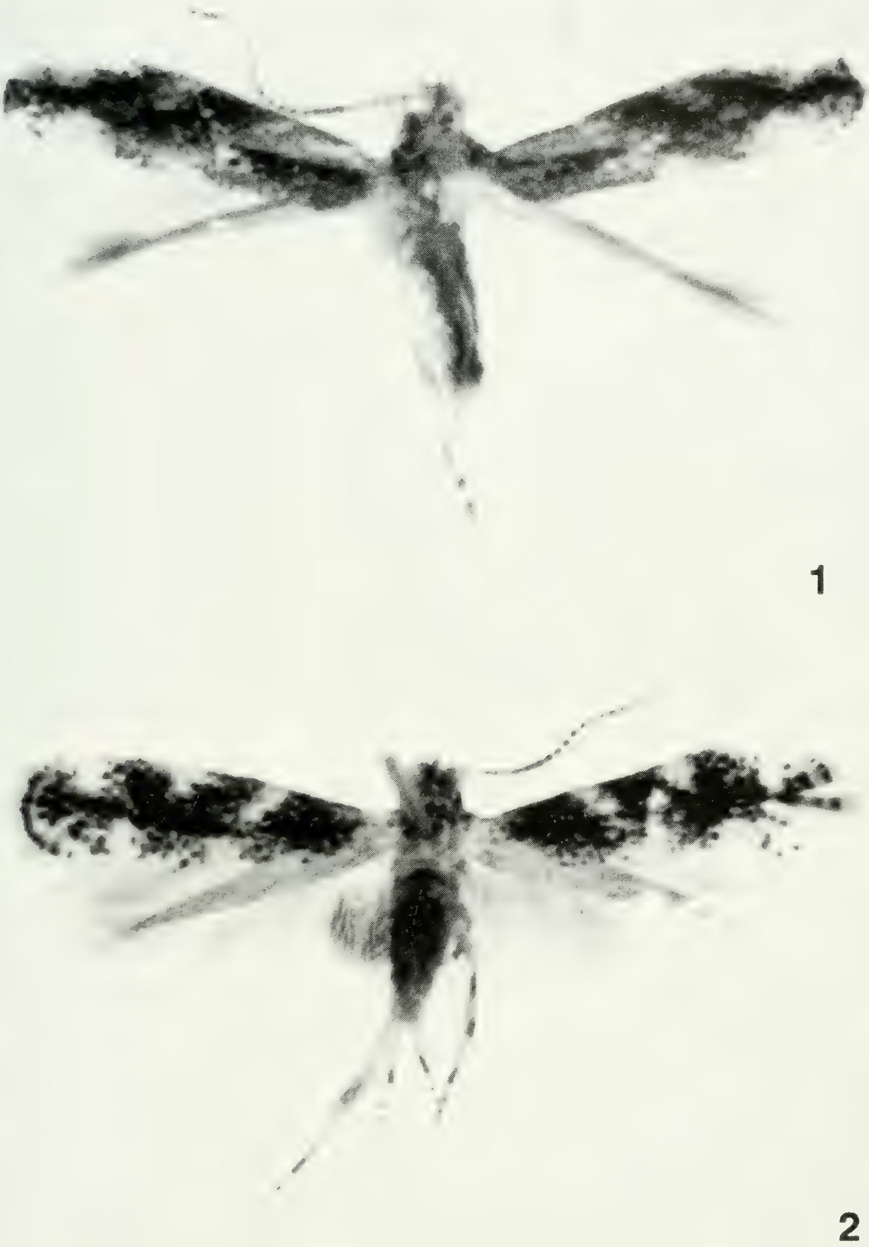
Bucculatrix caribbea Davis & Landry sp. n. Figs 1, 3, 4-46, 49, 50, 53, 54

Holotype ♂, BELIZE: Glovers Reef, Northeast Cay, 16°46'N 87°46'30"W, larva 19 Jan[uary] 1991, em[erged] 4 Feb[ruary] 1991 (D. R. Davis, DRD 859), Host: *Cordia sebestena* (USNM).

Paratypes with same data as holotype except: 2 ♂, 1 ♀, em. 22.i.1991; 1 ♂, 1 ♀, em. 1.ii.1991; 1 ♀, em. 9.ii.1991, slides USNM 30907, 30911, 30912, 30939, 30943, 30944, 30962, 30963 (USNM). MEXICO: Cozumel: Punta Norte: 4♂, 1 ♀, 1 cocoon, larva 24/28.xii.1990, em. 21/28.i.1991 (D. L. Wagner, DLW 90M122), *Cordia sebestena,* slide USNM 32387 (DLW, USNM).

Diagnosis. This species can be distinguished from the following closely allied species, *B. cordiaella*, by the generally darker forewings with fewer white strigulae (fig. 1). The male valva is divided almost to its base into lobes of similar size (fig. 45), and the anterior end of the female corpus bursae is not attenuated and contains shorter, broader signa (figs 49, 50).

Description (fig. 1). Frons white; vertex rough, consisting of long erect piliform scales mostly dark brownish fuscous with slight mixture of white in the



Figs 1-2
Adults. 1, *Bucculatrix caribbea* (Forewing length = 2.1mm). 2, *Bucculatrix cordiella* (Forewing length = 2.0mm).

center and all white peripherally; occipital scales white, broader; maxillary palpi not visible, apparently absent; pilifers not produced, with 2-3 short setae; labial palpi one segmented, short, not extending beyond margin of labrum; antenna about 3/4 the length of forewing; scape mostly white with a few scattered fuscous scales; pecten consisting of about 12-16 white scales; flagellum with one row of scales per segment, flagellomeres alternately white and fuscous except over distal third, where the pattern becomes one white flagellomere to three fuscous; haustellum not much longer than diameter of eye. Thorax pale grey, heavily irrorated with dark brown-tipped scales. Foreleg grayish fuscous dorsally, white ventrally; tarsi with 4 white basal bands on tarsomeres I-IV. Midleg mostly white to pale cream with two large diagonal dorsal bands of fuscous near base and subapex; basal half of tarsomeres I-IV white, remainder fuscous. Hindleg mostly white except for pale fuscous over dorsum of tibia and pale fuscous bands medially and dorsally on tarsomeres I-IV. Forewing length: 2.0-2.3 mm (holotype = 2.1mm). Forewing white, densely covered with dark brownish fuscous scales; dark scales concentrated in basal anal area and over much of distal half except where interrupted by two white costal strigulae and one larger, white dorsal strigula near tornus; basal most of the two white costal strigulae located at 3/5 and usually smaller, sometimes indistinct; fringe scales white. Hindwing pale gray with pale gray fringe scales; male frenulum with one large spine; female with two smaller spines. Abdomen dark greyish brown dorsally, white ventrally; male abdomen without eversible scale sac between tergites II and III.

Male genitalia (figs 45, 46). Tenth tergite (uncus) mostly membranous; gnathos and socii absent. Tegumen a moderately broad dorsal ring. Vinculum broadly U to V-shaped, nearly length of valva. Transtilla and juxta absent. Valva divided nearly to base; costal lobe approximately equal in width to saccular lobe; both lobes with scattered, elongate setae near apex. Aedoeagus cylindrical, approximately 1.3X length of valva; distal end of vesica with single large, apparently sclerotized cornutus.

Female genitalia (figs 49, 50). Papillae anales rounded, weakly sclerotized, spiculate, moderately setose. Apophyses posteriores basally very thin for short length before connection with papillae; with short subbasal extension directed ventroapically; straight on apical 2/3 and reaching basal third of segment VIII. Apophyses anteriores absent. Sternum VIII reduced, mostly unsclerotized, with ostium bursae arising from base or in intersegmental membrane between VII and VIII. Sternum VII with caudal margin excavated to level of ostium. Ductus bursae constricted to corpus; ductus seminalis arising near midlength. Corpus bursae slender, with caudal ring of 8-10 elongate signa, relatively short and broad; each signum with sparse row of 4-5 small teeth (fig. 50).

Larva (10 specimens examined) (figs 4-37). Initial mining instars not examined, probably apodal with flattened bodies (Braun, 1963). Third/ fourth(?) Instar: Maximum length 4 mm. Head moderately depressed, dark reddish brown; epicranial notch well developed, extending half length of head (fig. 5); 5 pairs of stemmata; cranial setae more reduced in length than in later instars; P 1 greatly reduced; P 2 absent. Labrum with 3 pairs of setae; M 3 and L 3 reduced. Hypopharynx 4-lobed, densely covered with short spines (figs 11, 12). Maxilla as in

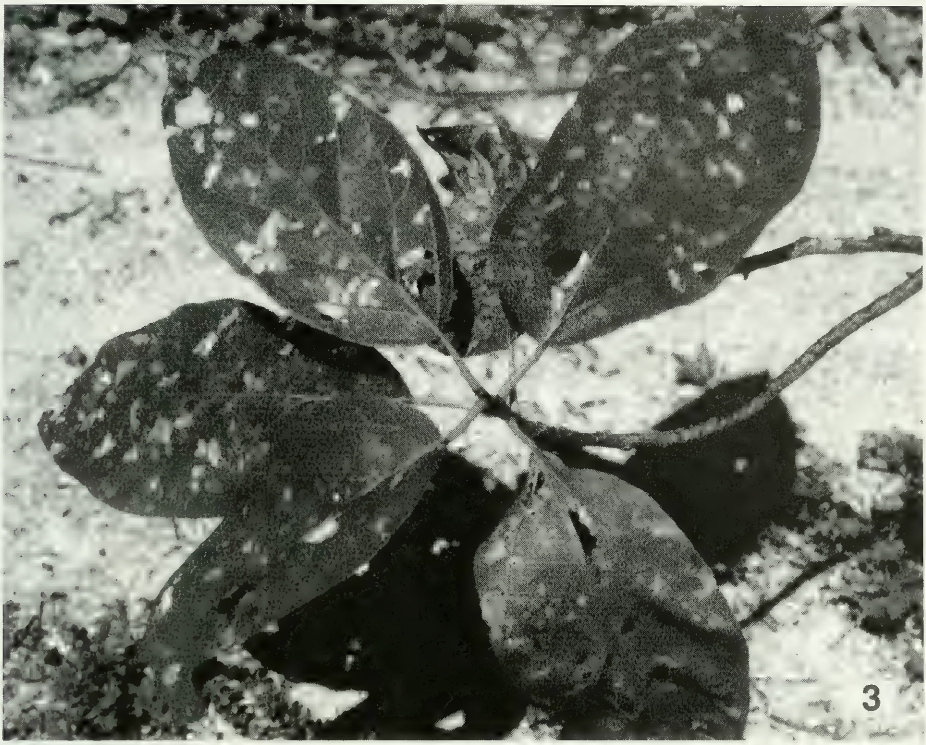
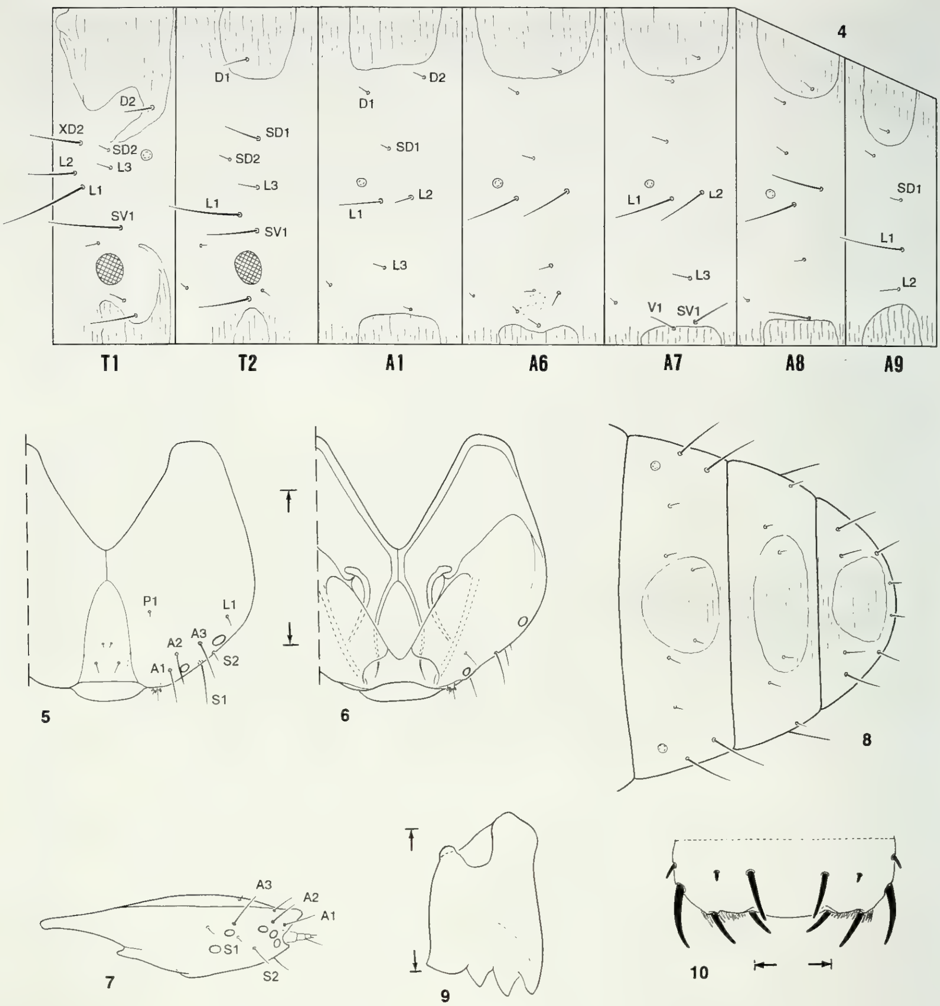


FIG. 3
Feeding damage of *Bucculatrix caribbea* on leaves of *Cordia sebestena*; Glover's Reef, Belize.

fig. 13; mesal lobe with short segment III, bearing 3 short basiconic apical sensillae and one extremely reduced sensillum. Antenna as shown in Figs 15, 16. Labial palpus with apical seta elongate, nearly 2X length of subapical seta (fig. 14). All segments of thorax and abdomen with dark reddish brown tergal and sternal plates; pronotal and prosternal plates with slender, curved extensions from caudal-lateral margins; prothorax (T 1) with D 1, SD 1, and XD 1 absent; L series trisetose; T 2-3 with D 2 absent; three pairs of legs present, with pretarsal claw of T 1 highly modified, strongly curved and greatly extended (fig. 18); legs of T 2 -3 with slightly reduced but otherwise normal claws; large, paired spatulate setae (fig. 19) present on T 2-3 legs, absent from T 1. Prolegs and crochets absent, but with paired ventral ambulatory callosities on A 3-6, 10 (fig. 20); A1-8 with L series trisetose. Final (Fifth?) Instar: Maximum length 4 mm. Head generally similar to preceding instar except less depressed, with more shallow epicranial notch; cranial setae more elongate than in preceding instars; P 2 present. Hypopharynx smoother, less spinose. Mesal lobe of maxilla with segment III much more elongate, with one apical sensillum greatly elongated, approximately as long as segment III (fig. 30). Antenna as shown in figs 31, 32, similar to preceding instar. Thorax and abdomen without darkly pigmented

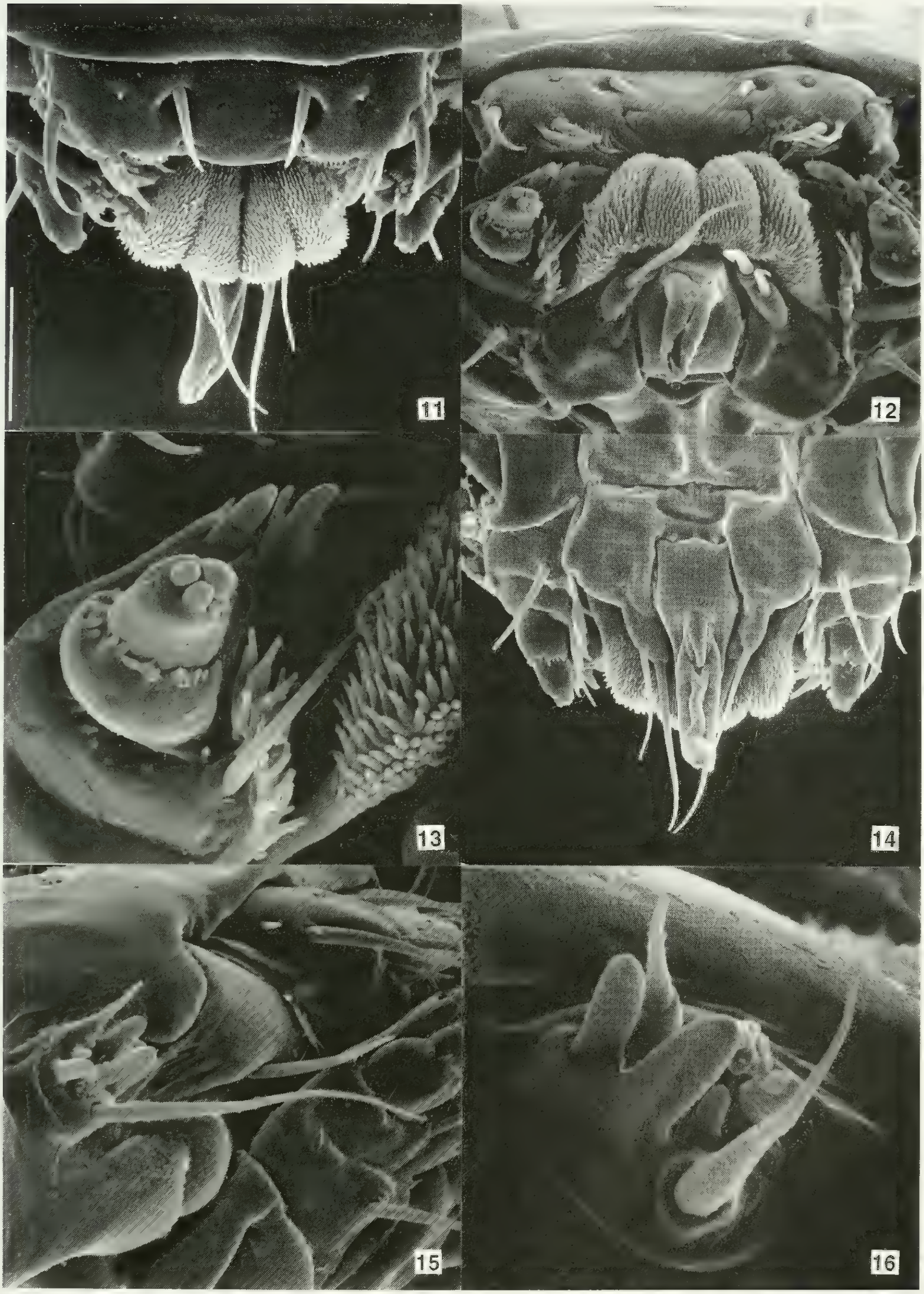


FIGS 4-10

Bucculatrix caribbea. Chaetotaxy of third/fourth (?) instar larva. 4, Lateral schematic of prothorax, mesothorax, metathorax, and abdominal segments 1, 2, 6-10. 5, Head, dorsal view (0.1mm). 6, Ventral view. 7, Lateral view. 8, Dorsal view of abdominal segments 8-10. 9, Mandible (0.02mm). 10, Labrum, dorsal view (0.02mm). (Scale lengths in parentheses.)

plates; chaetotaxy generally similar to preceding instar. Prothoracic leg with pretarsal claw similarly modified as above but with claw straight (fig. 33); T 1 leg also lacking paired, enlarged spatulate setae present on T 2-3. Prolegs present on A3-6, 10; ventral prolegs relatively elongate, tubular, with a partial circle of 6-7 crochets (figs 35, 36); anal prolegs much shorter, with approximately 4 crochets (fig. 37).

Pupa (1 specimen examined) (figs 38, 53, 54). Length: 2 mm. Frontal process (cocoon cutter) a small, simple, broadly triangular median spine (viewed laterally;



FIGS 11-16. *Bucculatrix caribbea*. Head morphology, third/fourth (?) instar larva. 11. Dorsal view of mouthparts (20μm). 12, Anterior view of mouthparts (20μm). 13, Maxilla (7.5μm). 14, Ventral view of mouthparts (25μm). 15, Lateral view of antenna (15μm). 16, Anterior view of antenna (6.7μm). (Scale lengths in parentheses; bar scale for all photographs shown in fig. 11.)

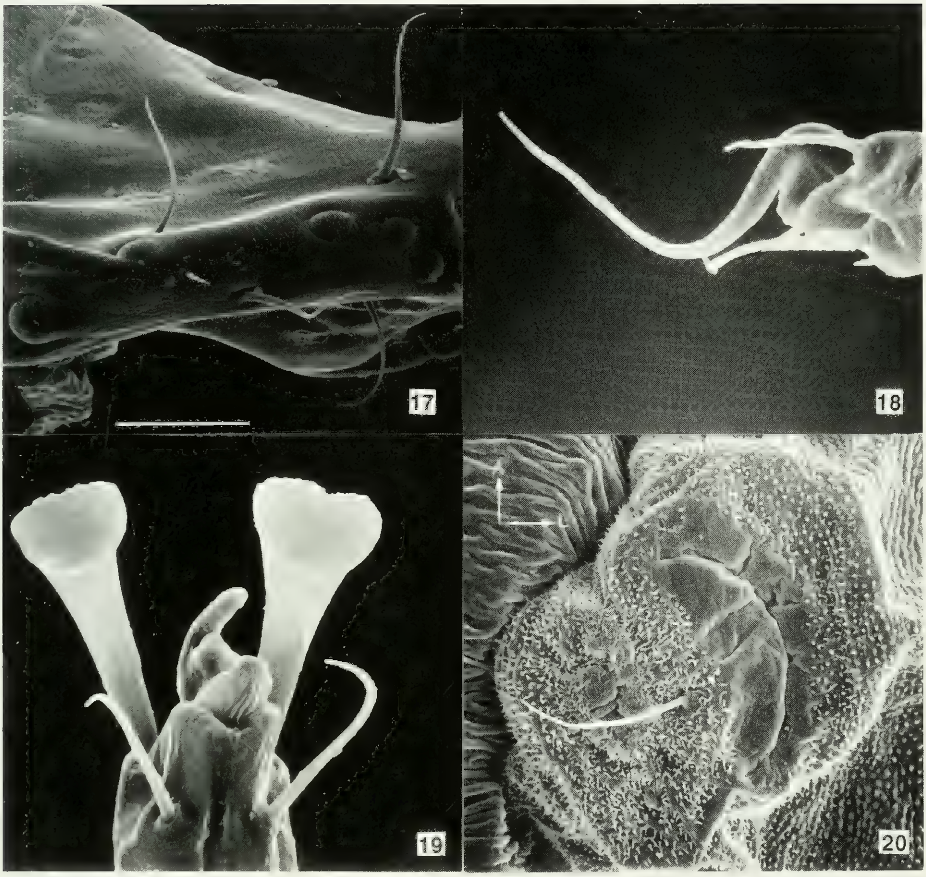
figs 38, 54). Antenna extending to caudal margin of A6. Forewings largely concealing hindwings, extending to middle of A7. Abdomen with segments 3-7 movable in male and 3-6 in female; a single transverse anterior row of small spines on A-3-8; A 10 relatively smooth, with 2 pairs of minute spines laterally.

Cocoons (figs 39-44). At least one and probably two flat, circular molting cocoons are constructed most likely by the third and fourth instar larvae respectively; molting cocoon about 1.5-2.0mm in diameter, constructed of loose, randomly spun, pale whitish silk (figs 39, 43, 44). Cocoon spun by final instar typical for genus in being white, elongate, 0.5mm wide and 2.2mm long, more intricately constructed (than molting cocoons), consisting of two parts of multi-layered, criss-cross silk strands reinforced by about 10 thickened, mostly dorsal, longitudinal ridges and 6-7 shorter, incomplete lateral ridges (figs 39-42); distinction between two parts obvious near anterior third where ridges are interrupted. Prior to adult emergence, pupal exuvium protrudes about halfway ventrally beneath anterior end.

Etymology. The specific name is derived from the geographical regional name Caribbean.

Biology. The egg is flat and cemented to the upper surface of the leaf of *Cordia sebestena*. The early instar larvae of *B. caribbea* commence feeding as upper side serpentine leaf miners and later enlarge the mine to a small, full depth blotch. In *B. caribbea* the mine usually extends a total length of 15-20mm and reaches a width of 5-6mm. The black larval frass is packed tightly into the serpentine portion of the mine and partway along either side of the blotch. Later the larva (probably third instar) exits near the terminal end of the mine on the underside of the leaf and spins a flattened, oval molting cocoon (figs 39, 43). The number of larval instars for this species was not determined. Five instars have been observed as typical for leaf-mining *Bucculatrix* (Braun, 1963), but this may vary somewhat. In those species whose larvae complete their feeding externally, it has been noted that only the first two instars and part of the third are passed within the mine. A similar cycle may be true for *B. caribbea*, but this requires confirmation. Thus, it is suspected that the third instar of *B. caribbea* also exits the mine and spins a molting cocoon, from which emerges the fourth instar that begins feeding externally, skeletonizing small patches of leaf. When the larval density becomes relatively high, leaf damage can be even more severe than illustrated (fig. 3). Evidently, the fourth instar constructs a second molting cocoon. The final instar (probably the fifth) completes its feeding and eventually constructs an elongate, ribbed cocoon (figs 39-42) on the underside and most frequently near the midrib of the leaf. Immediately prior to emergence, the pupa (or pharate adult) exits the cocoon, for approximately half its length, ventrally near the anterior end of the cocoon.

Distribution. This species is probably widespread along costal habitats in many parts of the Caribbean region where its host has become established. Currently it is known only from the island of Cozumel, Mexico and Glovers Reef, Belize. *Cordia sebestena* is widely cultivated in tropical areas and probably occurs naturally through much of the Caribbean region, from the Antilles and the Caribbean coasts of Central America, along the northern coasts of South America.

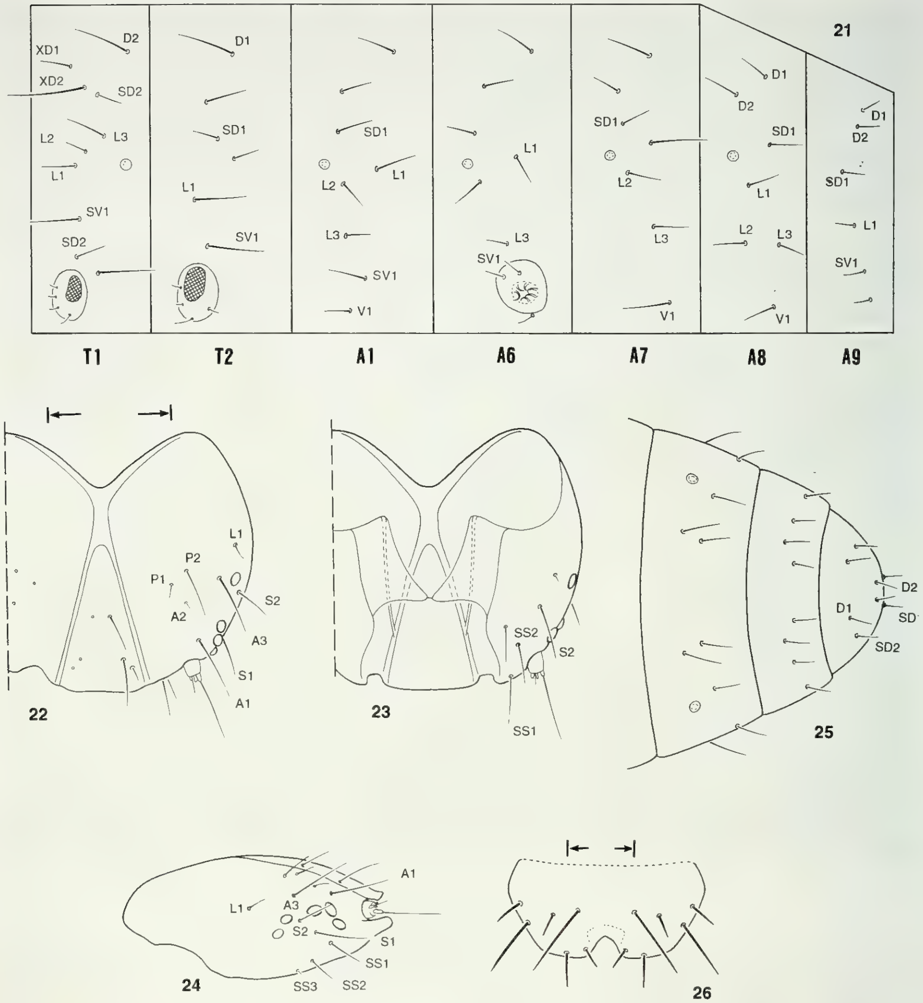


Figs 17-20

Bucculatrix caribbea. Morphology, third/fourth (?) instar larva. 17, Lateral view of stemmatal area (38µm). 18, Prothoracic pretarsal claw (12µm). 19, Mesothoracic pretarsus (12µm). 20, Ambulatory callus of 4th abdominal sternum (33µm). (A = anterior; L = lateral; scale lengths in parentheses; bar scale for all photographs shown in fig. 17.)

Remarks. During a preliminary survey conducted by D. Davis and C. Feller (Davis, 1993) on leaf-mining Lepidoptera associated with mangrove habitats in Belize, a population of this moth was encountered on the small island of Northeast Cay, the most forested and uninhabited of the Glovers Reef system of small, low islands. Adults were reared by DRD from a small cluster of heavily infested, shrubby trees of *Cordia sebestena* growing along the southeast shore of the Cay.

The extreme specialization of the prothoracic pretarsus in the larva merits further investigation throughout the genus. Because elongation of the tarsal claw is believed to occur only in those instars that spin cocoons, this may represent a specialization that assists in cocoon construction. The observed absence of a dorsal seta on the prothorax (and mesothorax of the penultimate instar) of the larva also



FIGS 21-26

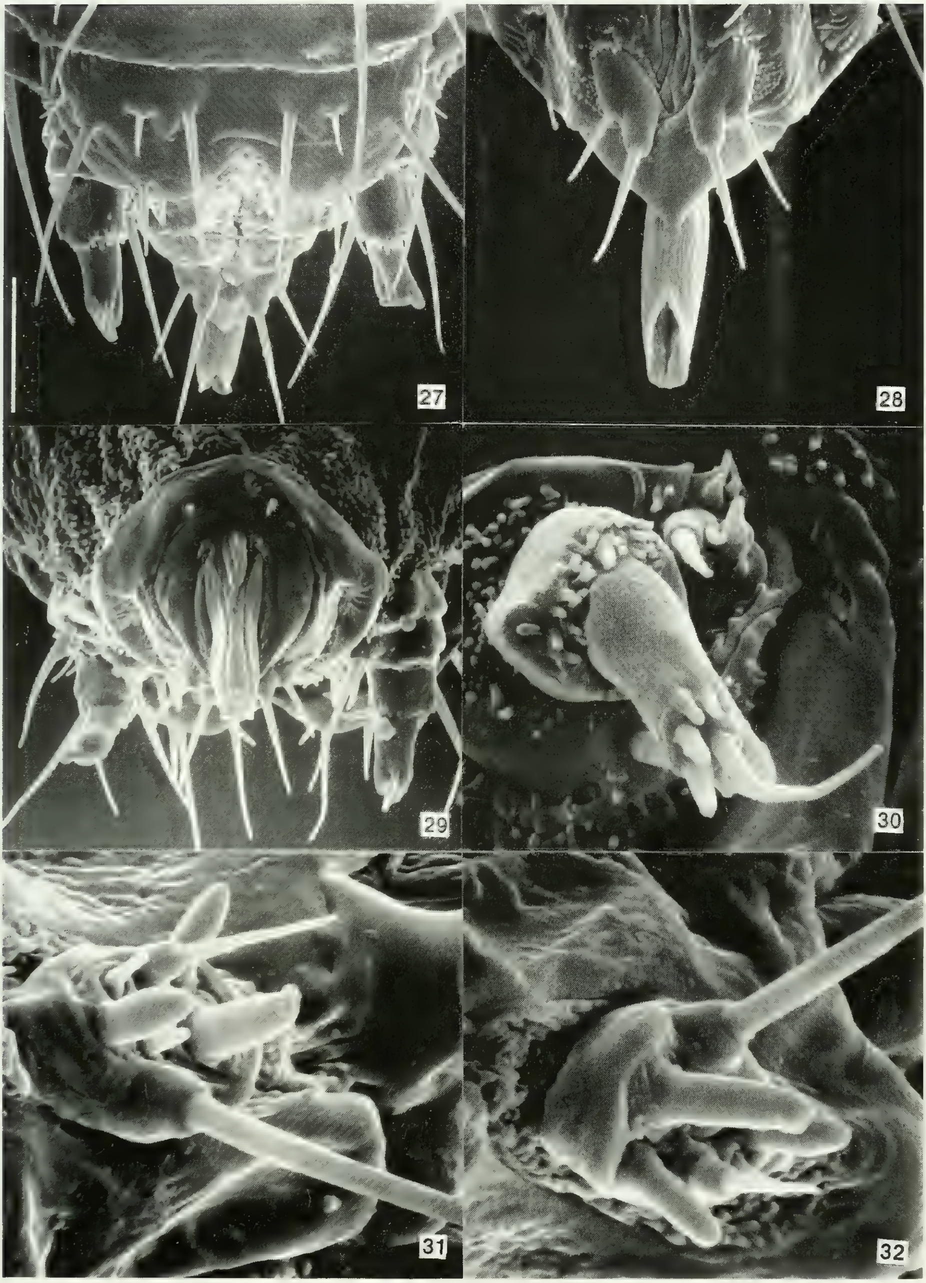
Bucculatrix caribbea. Chaetotaxy of fifth (?) instar larva. 21, Lateral schematic of prothorax, mesothorax, metathorax, and abdominal segments 1, 2, 6-10. 22, Head, dorsal view (0.1mm). 23, Ventral view. 24, Lateral view. 25, Dorsal view of abdominal segments 8-10. 26, Labrum, dorsal view (0.02mm). (Scale lengths in parentheses.)

needs to be confirmed with more material. Both Braun (1963) and MacKay (1972) show both setae present in *Bucculatrix*.

Bucculatrix cordiaella Davis & Landry sp. n. Figs 2, 47, 48, 51, 52

Holotype ♂, ECUADOR: Galápagos, Genovesa, Bahía Darwin, 25.iii.1992, M[ercury] V[apour] L[amp] (B. Landry), slide BL 1321 (MHNG).

Paratypes. 7 ♂, 18 ♀, 1 of sex undetermined (unspread and not dissected) from the Galápagos islands: Floreana: 2 ♀ (slide BL 1319), Punta Cormoran, 21.iv.1992, M[ercury]



FIGS 27-32. *Bucculatrix caribbea*. Head morphology, fifth (?) instar larva. 27, Dorsal view of mouthparts (20μm). 28, Dorsal view of labial palpi and spinneret (15μm). 29, Ventral view of mouthparts (20μm). 30, Maxilla (6μm). 31, Antenna, lateral view (8.6μm). 32, Antenna, anterior view (8.6μm). (Scale lengths in parentheses; bar scale for all photographs shown in fig. 27)

V[apour] L[amp] (B. Landry). Genovesa: 2 ♂ (slide BL 1320), 2 ♀, same data as holotype; one of sex undetermined, same data as holotype except date (10.iii.1992); 2 ♂ (slide BL 1308 [genitalia], BL 1323 [head]), 4 ♀ (slide BL 1309), same data as holotype except date (26.iii.1992). Isabela: 2 ♂, 2 ♀, Alcedo, low arid zone, 17.iv.1998, minadores de *Cordia lutea* (L. Roque). Santa Cruz: 1 ♂, 6 ♀ (slides USNM 32335, 32336), Tortuga Bay, 10 m, 18.iii. 2001, reared from *Cordia lutea* (L. Roque). Santiago: 1 ♀ (slide BL 1322), Cerro Inn [= Bahía Sullivan], 28.iii.1992, M[ercury] V[apour] L[amp] (B. Landry). Seymour Norte: 1 ♀, arid zone, 23.i.1989, M[ercury] V[apour] L[amp] (B. Landry). (BMNH, CDRS, CNC, MHNG, USNM).

Diagnosis. With a wingspan of about 5 mm, this is among the smallest of all Lepidoptera species of the Galápagos. Its wing pattern, biology (an early instar leaf miner on *Cordia lutea*), and general shape and structure of the ribbed cocoon will immediately separate it from other moths of the archipelago. From its sister species, *B. caribbea*, it differs in possessing more distinct forewing strigulae (fig. 2), the male valva has a more slender, curved costal lobe (fig. 47), and the anterior portion of the female corpus bursae is more attenuated and possesses a more elongate, slender signa (figs 51, 52).

Description (fig. 2). Frons white; vertex with long and erect piliform scales mostly brown in middle, with more white scaling peripheral to tuft than in *B. caribbea*, with few broader, white scales along occiput; maxillary palpi and pilifers as in *B. caribbea*; labial palpi one segmented, kidney-shaped, poorly sclerotized, especially toward apex, not extending beyond margin of labrum; antenna 2/3 length of forewing; scape mostly white, with few brown-tipped scales; pecten made of 12-15 white scales; flagellum with alternate brown and white rings throughout, 19-segmented (n=1); first male flagellomere not curved, about twice as long as pedicel (first two flagellomeres apparently fused); haustellum not much longer than diameter of eye. Thorax mostly covered with brown-tipped white scales. Foreleg white with brown laterally on femur, tibia, tarsomere I, and apex of tarsomeres II-IV. Midleg white with brown laterally on femur, on tibia laterally as two large diagonal bands at base and subapically, on second half of tarsomere I, and apex of tarsomeres II-IV. Hindleg white with pale greyish brown on most of lateral surface of tibia, and brown dorsally on second half of tarsomere I, and apex of tarsomeres II-IV. Forewing length: 1.83 - 2.17 mm (holotype = 2.0 mm). Forewing white with pattern of brown and brown-tipped scales as large band subbasally, sometimes appearing diagonal; large V-shaped marking connecting middle of costa to inner margin at about 2/3 and costa again at 3/4; posterior branch of V connected to apical patch by narrow longitudinal band near middle; subbasal band loosely connected with V-shaped marking by few scales near cubital fold; larger basal scales of fringe pale greyish brown at base and

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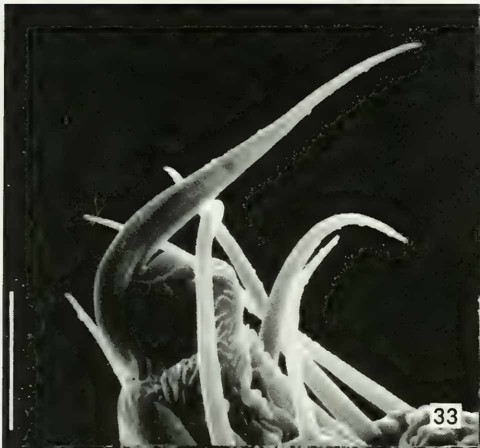
FIGS 33-38

Bucculatrix caribbea. Larval morphology, fifth (?) instar; pupa. 33, Prothoracic pretarsal claw (10µm). 34, Mesothoracic pretarsus (12µm). 35, Proleg, 4th abdominal segment (17.6µm). 36, Crochets of fig. 35 (12µm). 37, Abdominal segment 10, caudal view (60µm). 38, Pupa, lateral view of frontal process (cocoon cutter) (60µm). (Scale lengths in parentheses; bar scale for all photographs shown in fig. 33)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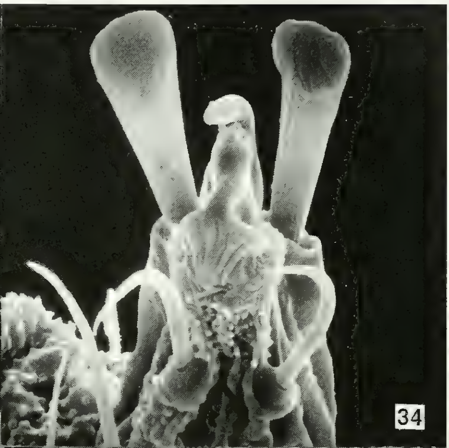
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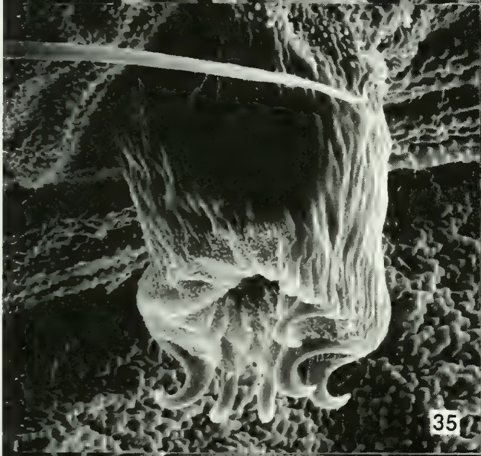
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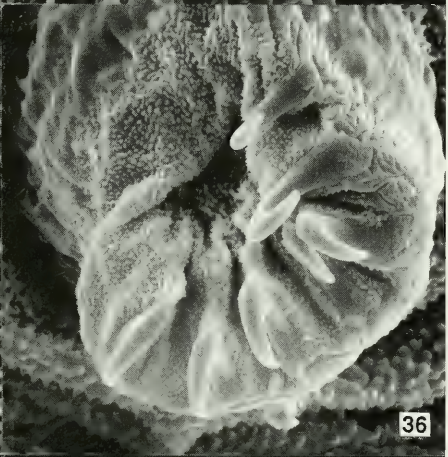
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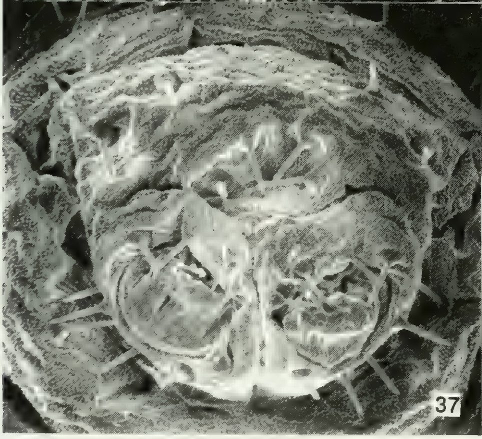
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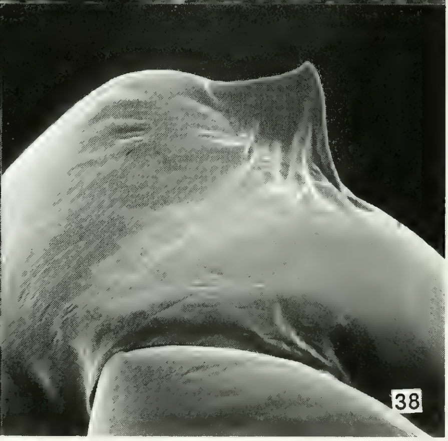
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dark brown at apex, thinner scales pale grey. Hindwing pale greyish brown with concolorous fringe. Frenulum similar to that of *B. caribbea* in both sexes. Abdomen as described for *B. caribbea*.

Male genitalia (figs 47, 48). Uncus membranous, densely setose laterally; gnathos and socii absent. Tegumen a narrow dorsal ring; more slender than in *B. caribbea*. Vinculum broadly V-shaped, about 0.3 length of valva. Transtilla, juxta absent. Valva divided nearly 0.75 its length; costal lobe slightly curved dorsally, about 1/3 width of saccular lobe at middle; cluster of 4-6 stout, subapical spines present; saccular lobe slightly longer than costal lobe, apically narrower than base and rounded, with rather short setae from 1/3 to apex and shorter spines at about 2/3 on median side. Aedoeagus simple, cylindrical, almost straight except for slightly angled short coecum penis; vesica scobinate, without cornuti.

Female genitalia (figs 51, 52). Papillae anales and apophyses posteriores similar to those of *B. caribbea*. Sternite VIII with large, circular unsclerotized region medially between basal and apical margins at base of which is membranous ostium bursae; basal margin with short, rounded projection on each side; with longitudinal groove medially from middle of sternite to beyond middle of following intersegmental membrane. Caudal margin of sternite VII medially with wide (2/5 width of segment), short, and more strongly sclerotized extension that is shallowly emarginate apically. Ductus bursae membranous and of medium girth on basal 1/4, subsequently enlarged slightly, with ring of approximately 12-14 elongate, rodlike signa which are smooth for 1/4 their caudal length and sparsely dentate for remainder (fig. 52); apical ends of signa radiating from inflated anterior end of ductus bursae. Connection of ductus seminalis with ductus bursae at about 2/5. Corpus bursae rather large, ovate, with narrow band of quasi-alveolate pattern near middle.

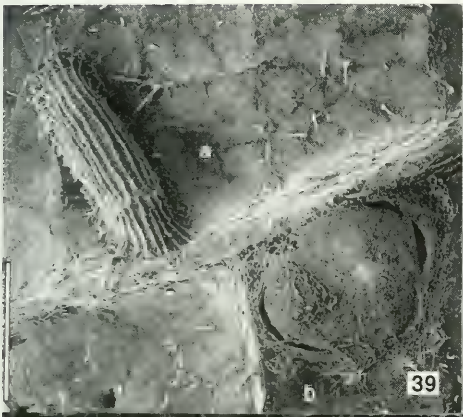
Immature stages. Unknown.

Etymology. The specific epithet is derived from the generic name of the host plant, *Cordia*.

Biology. Early instar larvae mine the upper leaf surfaces of *Cordia lutea* Lam. (Boraginaceae). Later instar larvae apparently feed outside the mines, but this requires confirmation. Mature mines are up to 5mm wide and 15mm long, of which the narrow, 0.5-1.0mm broad serpentine mine often comprises half the length. In early June 2001, LR observed larvae suspended from silk threads in great numbers toward the end of the day. Many of these larvae were preyed upon in midair by wasps identified as *Pachodynerus gaullei* Brèthes, 1920 (syn. = *P. galapagensis* (Williams, 1926)) (Vespidae). The *Bucculatrix* larvae were taken to the wasps' nests and fed upon by the wasps or given to the wasps' larvae. Moths come to light and were collected in January, March, and April.

FIGS 39-44

Bucculatrix caribbea. Cocoon morphology. 39, Ribbed pupal cocoon (a) of last instar larva and molting cocoon (b) of third/fourth instar larva (1.5mm). 40, Lateral view of pupal cocoon (0.86mm). 41, Detail of rib construction of pupal cocoon (75μm). 42, Dorsal view of fig. 40 (0.86mm). 43, Molting cocoon of third/fourth instar larva (0.86mm). 44, Detail of molting cocoon construction (75μm). (Scale lengths in parentheses; bar scale for all photographs shown in fig. 39)



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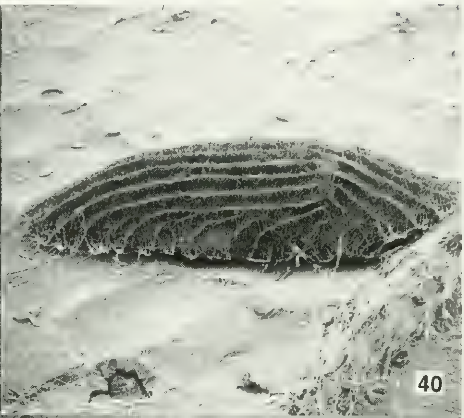

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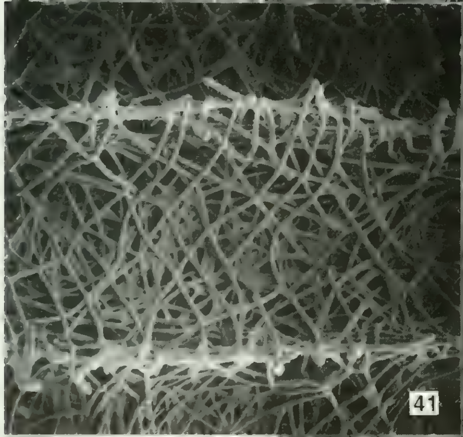

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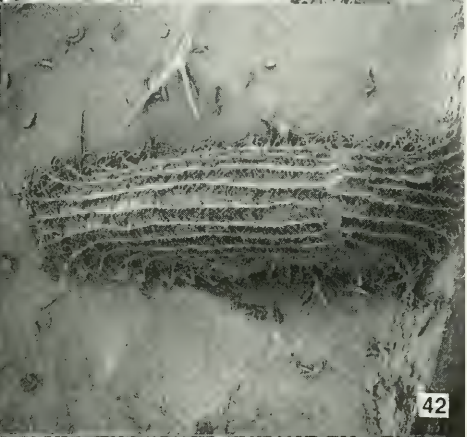

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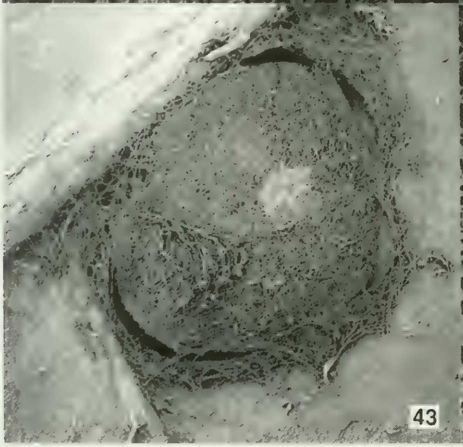

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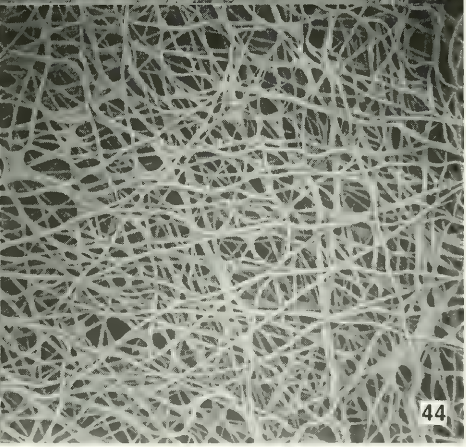

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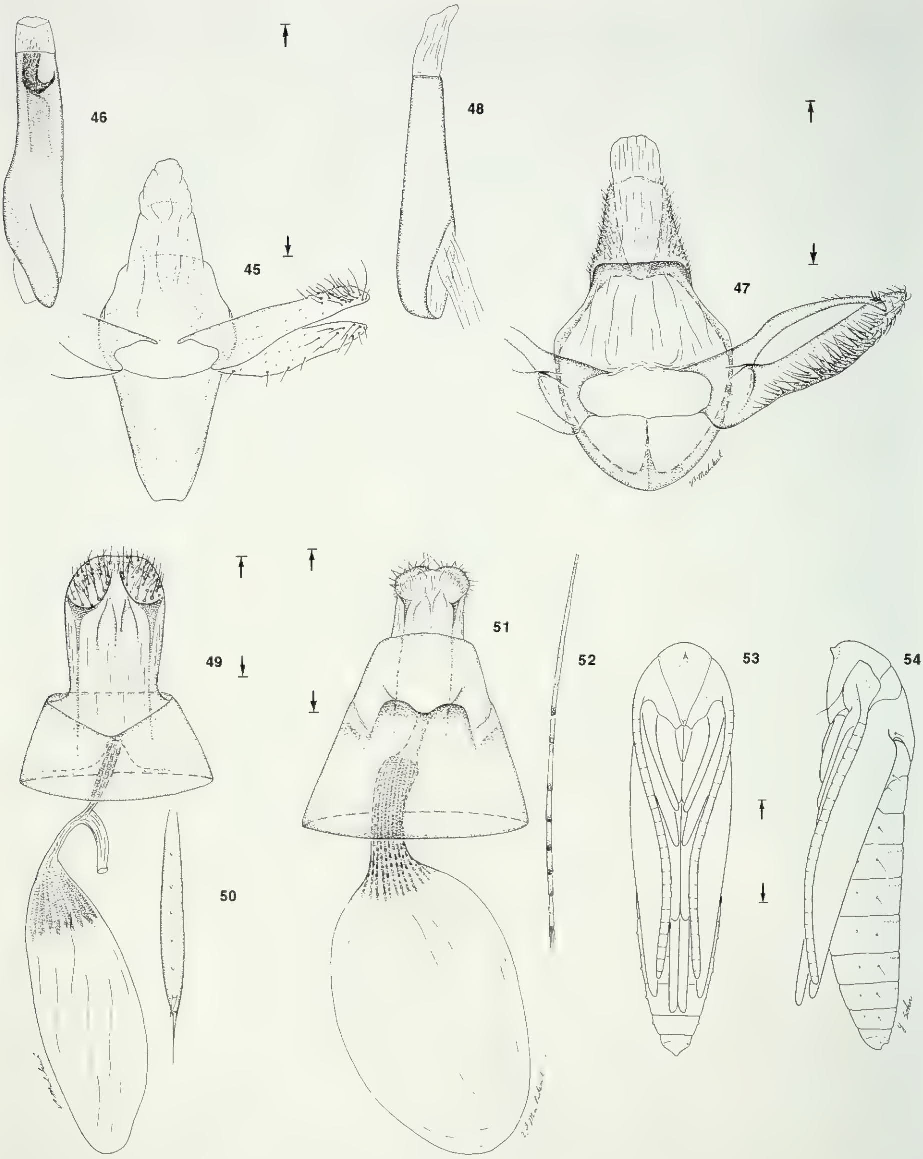

FIGS 45-54

Bucculatrix, male and female genitalia; pupal morphology. 45, *B. caribbea*, ventral view of male genitalia (0.25mm). 46, Aedoeagus. 47, *B. cordiella*, ventral view of male genitalia (0.25mm). 48, Aedoeagus. 49, *B. caribbea*, ventral view of female genitalia (0.25mm). 50, Enlarged detail of signum in fig. 49. 51, *B. cordiella*, ventral view of female genitalia (0.25mm). 52, Enlarged detail of signum in fig. 51. 53, *B. caribbea*, ventral view of pupa (0.5mm). 54, Lateral view of fig. 53. (Scale lengths in parentheses.)

Distribution. The species has been collected on the Galápagos islands of Floreana, Genovesa, Isabela, Santa Cruz, Santiago, and Seymour Norte, always near sea level.

Remarks. Collected first in 1989 by BL, *B. cordiaella* attained high population levels at the Charles Darwin Research Station (CDRS), Santa Cruz Island, in March 2001. Because the host plant, *Cordia lutea* Lam., is rather common at lower elevations, the authorities of the Galápagos National Park were alarmed by the intensive leaf damage caused by larval feeding. An electronic message with an image of the leaf damage was sent to BL by LR, and forwarded to DRD for his advice. After an exchange of messages between Washington and the CDRS, a generic identification was made on the basis of the characteristic cocoon structure, and this identification was further confirmed after DRD received material from LR. The species proved to be the same as the one collected by BL on four other islands of the archipelago in 1989 and 1992 that had been identified as a *Bucculatrix* by DRD in 1992. Examination of the types of the New World *Bucculatrix* species in the National Museum of Natural History, Washington, D.C. (USNM) and The Natural History Museum, London (BMNH) by BL and DRD had revealed that the species was new to science.

Cordia lutea, also known as Yellow cordia, or muyuyo, is native to the Galápagos and to mainland Ecuador and Peru. It is a small tree or shrub that inhabits the arid lowlands. In addition to the islands mentioned above, where the moth was found, *Cordia lutea* is found on the islands of Baltra, Española, Marchena, Pinta, Pinzón, Rábida, San Cristóbal, Santa Fé, Wolf, and some islets (McMullen 1999).

A color illustration of the forewing of *B. cordiaella* is presented on the web site of the MHNG: www.geneva-city.ch:80/MUSINFO/mhng/page/photgala.htm.

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We are very thankful to the authorities of Galápagos National Park and those of the Charles Darwin Research Station for allowing fieldwork and for logistical support to BL in 1989 and 1992. This fieldwork was supported by an operating grant to Prof. Stewart B. Peck, Carleton University, Ottawa, Canada, from the Natural Sciences and Engineering Research Council of Canada, for field research on arthropod evolution. The following persons were excellent field companions to BL: Joyce Cook, Moraima Inca, Ricardo Palma, Stewart B. Peck, Bradley J. Sinclair, and Eduardo Vilema. We thank curator Kevin Tuck, The Natural History Museum, London, England, for his help in the examination of specimens. We are grateful to the Charles Darwin Research Station and the Galápagos Conservation Trust of England for providing financial support with regard to the investigations of BL at the BMNH in 2000. David Wagner, University of Connecticut, Storrs, CT, USA, kindly provided us with adult *Bucculatrix* that he had reared from *Cordia sebestena* in Cozumel, Mexico, and reviewed the manuscript. We are indebted to Vichai Malikul and George Venable, Department of Entomology, Smithsonian Institution, for the illustrations. Susann Braden of the Smithsonian Scanning Electron Microscope Laboratory and

John Steiner of the Smithsonian Photographic Services assisted with the photographs. The fieldwork of DRD in Belize was supported by a grant from the Smithsonian Caribbean Coral Reef Ecosystems Program through the program director, Klaus Reutzler.

REFERENCES

Braun, A. F. 1963. The genus *Bucculatrix* in North America north of Mexico. *Memoirs of the American Entomological Society* 18: 1-208, 45 pls.

Davis, D. R. 1983. Lyonetiidae (pp. 8-9). *In*: Hodges, R. W. *et al.* (eds). Check List of the Lepidoptera of America North of Mexico. *E.W. Classey Ltd. and the Wedge Entomological Research Foundation, London*, xxiv + 284 pp.

Davis, D. R. 1987. Micropterigidae, Eriocraniidae, Acanthopteroctetidae, Nepticulidae, Opostegidae, Tischeriidae, Heliozelidae, Adelidae, Incurvariidae, Prodoxidae, Tineidae, Psychidae, Ochsenheimeriidae, Lyonetiidae, Gracillariidae, Epipyropidae, pp. 341-378, 456, 459, 460. *In*: Stehr, F.W. (ed.). Immature insects. *Kendall-Hunt, Dubuque, IA*, xiv + 754 pp.

Davis, D. R. 1989. Generic revision of the Opostegidae, with a synoptic catalogue of the World's species (Lepidoptera: Nepticuloidea). *Smithsonian Contributions to Zoology* 478: 1-97.

Davis, D. R. 1993. Biology and systematics of plant mining Mangrove Lepidoptera. Page 8. Caribbean Coral Reef Ecosystems Report. *National Museum of Natural History, Smithsonian Institution.*

Davis, D. R. & Miller, S. E. 1984. Lyonetiidae (p. 25). *In*: Heppner, J. B. (ed.). Atlas of Neotropical Lepidoptera, Checklist: Part 1, Micropterigoidea - Immoidea. *Dr. W. Junk Publishers, The Hague*, xxvii + 112 pp.

Davis, D. R. & Robinson, G. S. 1999. The Tineoidea and Gracillarioidea (pp. 91-117). *In*: Kristensen, N. P. (ed.). Handbook of Zoology, Lepidoptera, Moths and Butterflies, Vol. 1: Evolution, Systematics, and Biogeography. *Walter de Gruyter, Berlin & New York.* x + 491 pp.

Kumata, T. 1978. A new stem-miner of alder in Japan, with a review of the larval transformation in the Gracillariidae (Lepidoptera). *Insecta Matsumurana (new series)* 13: 1-27.

Mackay, M. R. 1972. Larval sketches of some Microlepidoptera, chiefly North American. *Entomological Society of Canada, Memoir* No. 88: 1-83.

Mcmullen, C. K. 1999. Flowering plants of the Galapagos. *Cornell University Press*, 370 + xiv pp.

Needham, J. G., Frost, S. W. & Tothill, B. H. 1928. Leaf-mining insects. *Williams & Wilkens. Baltimore, MD.*

Rubinoff, D. Z. & Osborne, K. H. 1997. Two new species of Asteraceae-feeding *Bucculatrix* (Bucculatricidae) from California. *Journal of the Lepidopterists' Society* 51: 227-236.

Wagner, D. L., Loose, J. L., Fitzgerald, T. D., De Benedictis, J. A. & Davis, D. R. 2000. A hidden past: the hypermetamorphic development of *Marmara arbutiella* (Lepidoptera: Gracillariidae*). Annals of the Entomological Society of America* 93: 59-64.

REVUE SUISSE DE ZOOLOGIE 109 (2): 295-323; juin 2002

Specie dei generi *Eusteniamorpha* Cameron e *Autalia* Leach del Borneo (Coleoptera, Staphylinidae) *

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The species of the genera *Eusteniamorpha* Cameron and *Autalia* Leach from Borneo (Coleoptera, Staphylinidae). - A collection of Aleocharinae of the genera *Eusteniamorpha* Cameron and *Autalia* Leach is studied. Nineteen species of the genus *Eusteniamorpha* and one of the genus *Autalia* Leach are described as new. Each new species is illustrated and compared to the closely related species from Philippines and Java. The genus *Balda* Blackwelder is placed in synonymy with *Eusteniamorpha*. A key of all Bornean species of *Eusteniamorpha* is provided.

Key-words: Coleoptera – Staphylinidae – Aleocharinae – taxonomy – Borneo.

INTRODUZIONE

Il genere *Eusteniamorpha* Cameron, 1920, comprende specie fitodetriticole forestali del suolo, diffuse a Giava, Bali, Nepal, Filippine, Birmania, Malaysia, Singapore, Cina, Thailandia e Celebes. Una sola specie, *E. borneensis* Cameron, 1933, era nota del Borneo (M. Kinabalu).

Grazie alle ripetute ricerche del Dr, Aleš Smetana di Ottawa e dei Dr. Ivan Löbl e B. Burckhardt, il primo già del Museo di Storia naturale di Ginevra, il secondo del Museo di Storia Naturale di Basilea, ora il numero delle specie del genere *Eusteniamorpha* sale a 20, essendo 19 nuove per la scienza. Notevole è la scoperta di due specie attere o microttere, con occhi ridotti, perciò probabilmente strettamente endemiche del M. Kinabalu.

Nel presente lavoro sono compresi anche un esemplare raccolto dal Prof. Herbert Franz di Mödling (Austria) e uno raccolto dal collega Guillaume de Rougemont (Londra). Unitamente alla trattazione delle specie del genere *Eusteniamorpha* ho aggiunto la descrizione di una nuova specie del genere *Autalia* Leach, la prima del Borneo.

Gli holotypi delle nuove specie sono conservati nel Museo di Storia naturale di Ginevra (MHNG), nel Museo regionale di Scienze naturali di Torino (MRSNT) e in collezione Franz (CFR). Paratypi si conservano Museo di Storia naturale di Ginevra e nella collezione dell'autore.

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* 170° Contributo alla conoscenza delle Aleocharinae.
Manoscritto accettato il 04.01.2002

IL GENERE *EUSTENIAMORPHA* CAMERON

Il genere *Eusteniamorpha* è stato descritto per una specie di Singapore: *E. rufa* Cameron, 1920. Nel compararlo con il genere *Eustenia* Fauvel, 1905, di Giava, Cameron giustifica la sua creazione grazie alla presenza della formula tarsale 3-4-4, mentre in *Eustenia* la formula tarsale, secondo Fauvel, sarebbe 4-4-5 (sic!). Ciò, nonostante l'estrema affinità dell'habitus a confronto tra le specie *rufa* e quella di Giava (*E. aspera* Fauvel). Nel 1928 Bernhauer riconobbe l'identità del genere *Eusteniamorpha* con *Eustenia.* Infatti afferma: *"Die äußere Form des Körpers stimmt mit der Beschreibung der Gattung* Eustenia *Fauv., Rev. d'Ent., 1905, p. 145, so genau überein, daß ich der Angabe Fauvels über die Tarsenzahl seiner Gattung (4-4-5) annehmen möchte, daß die beiden Gattungen miteinander identisch sind und die Angabe Fauvels auf einem Beobachtungsfehler beruht".* Pur riconoscendo l'identità del genere *Eusteniamorpha* con il genere *Eustenia,* Bernhauer, stranamente, utilizza il genere *Eusteniamorpha* e non il genere *Eustenia,* che aveva priorità.

Nel 1952, Blackwelder, ignorando l'osservazione di Bernhauer, per il genere *Eustenia* Fauvel, 1905, propone il nuovo nome di *Balda* Blackwelder, 1952, in quanto omonimo del genere *Eustenia* Sneller, 1899. Un mio esame dell'holotypus ♀ di *E. aspera,* tipo del genere *Eustenia* Fauvel e del lectotipo ♂ (da me designato nel 1993, figg. 54-58) di *E. rufa* Cameron, 1920, tipo del genere *Eusteniamorpha,* mi ha permesso di constatare che il genere *Eusteniamorpha* Cameron è effettivamente nuovo sinonimo di *Eustenia* Fauvel. Ciò è dovuto a un errore di osservazione di Fauvel che ha dato la formula tarsale 4-4-5, invece di 3-4-4, come ho riscontrato sull'holotypus di *E. aspera,* mediante preparati microscopici in balsamo del Canadà. La ligula intera, il mento profondamente incavato al margine anteriore e altri caratteri, oltre alla formula tarsale, si riscontrano sia in *Eustenia*, sia in *Eusteniamorpha.* Con la constatazione che il genere *Eusteniamorpha* è sinonimo di *Eustenia* Fauvel e che quest'ultimo non è valido, perché omonimo di *Eustenia* Sneller, sostituito dal nuovo nome *Balda* Blackwelder, quest'ultimo si rende non necessario, perché è disponibile il genere *Eusteniamorpha,* quale sinonimo di *Eustenia* Fauvel. Perciò *Balda* Blackwelder, 1952 è **n. syn.** di *Eusteniamorpha* Cameron, 1920.

Il genere *Eusteniamorpha* era segnalato anche del Congo, Angola e Ruanda, quando l'esame di materiale africano e del Madagascar, mi ha permesso di riconoscere che nella regione etiopica era diffuso un genere affine (*Eustenidia* Pace, 1984), data la presenza in questo genere di una ligula lunga, stretta e divisa all'apice e della formula tarsale 4-5-5. Nonostante che quest'ultima sia ben differente da quella di *Eusteniamorpha* (3-4-4) e spesso scelta dagli autori quale carattere fondamentale per l'istituzione di una nuova tribù, date le affinità morfologiche esterne e spesso quelle dell'edeago e della spermateca, ho creduto opportuno attribuire, anche recentemente (Pace, 1999) alla tribù Eusteniamorphini il genere *Eustenidia,* nonostante la disparità della formula tarsale. Ciò dimostrerebbe ulteriormente che la suddivisione tribale tradizionale della sottofamiglia Aleocharinae ha bisogno di una revisione alla luce delle recenti scoperte.

MATERIALE TIPICO DEL BORNEO ESAMINATO

Eusteniamorpha borneensis Cameron, 1933 Figg. 37-39

Eusteniamorpha borneensis Cameron, 1933: 350

Holotypus ♂, B.N. Borneo, Mt. Kinabalu, Lumu Lumu, 5500 feet, 6.4.29, *E. borneensis* Cam. type (The National History Museum, London).

Nota. La descrizione data da Cameron coincide con le mie osservazioni, tranne per il pronoto che Cameron afferma essere "*a little broader than long*", mentre invece è lungo quanto largo. Anche l'affermazione "*a little dilated anterior part ....almost impunctate*" è imprecisa dato che la punteggiatura su questa parte anteriore del pronoto è molto fine, allineata a ciascun lato del solco mediano, assente sia presso il solco, sia ai lati del pronoto.

Questa specie, essendo nota per il solo ♂, è di difficile avvicinamento tassonomico ad altre specie. Infatti l'edeago non mostra evidenti caratteri morfologici che permettano di riconoscere sicure affinità tra le specie. E', al contrario, la spermateca che mostra caratteri differenziali specifici eccellenti per il riconoscimento di gruppi di specie tra loro affini, come dimostrato ampiamente nel presente lavoro, nella discussione data dopo la chiave delle specie.

METODO

I caratteri differenziali più stabili, perciò più utilizzabili per distinguere le specie del genere *Eusteniamorpha* del Borneo, si trovano nella forma degli antennomeri, sullo sviluppo oculare, sulla presenza o assenza di granulosità sul capo, pronoto e addome, sulla presenza di solchi e fossette sul pronoto, sulla forma dell'edeago e della spermateca. Quest'ultima presenta caratteri eccellenti per riconoscere e raggruppare specie affini. Infatti il bulbo distale può essere globulare, più o meno allungato, senza essere seguito o seguito da un tratto a spirale più o meno stretto. L'edeago presenta caratteri differenziali meno evidenti e non utili per il riconoscimento di gruppi di specie e, rinvenendosi nella cavità addominale spesso con sacco interno estroflesso, non dà dati comparabili per una solida classificazione naturale. A un'osservazione superficiale da parte di qualche entomologo smanioso di ricerche di immaginate sinonimie, alcune specie del Borneo qui descritte, potrebbero sembrare uguali ad alcune altre note delle Filippine, per esempio *E. punctipennis* Bernhauer, 1928, affine a *E. burckhardti* sp. n., *E. monstrosicollis* Bernhauer, 1928, affine a *E. eleganticollis* sp. n. E' la somma dei caratteri esterni, dell'edeago e della spermateca, quella che permette di evidenziare la separazione delle specie, anche se alcuni caratteri si riscontrano quasi uguali, ma isolati, e comuni a due o tre specie

A conclusione dell'esame delle specie qui descritte, si percepisce la conferma che l'insularità del Borneo è stata un singolare laboratorio dell'evoluzione anche delle specie del genere *Eusteniamorpha.*

ELENCO DELLE SPECIE DEL BORNEO ESAMINATE

EUSTENIAMORPHINI Bernhauer & Scheerpeltz, 1926

Eusteniamorpha strictipennis sp. n.
Eusteniamorpha introflexa sp. n.
Eusteniamorpha subtiliapex sp. n.
Eusteniamorpha deiectorum sp. n.
Eusteniamorpha burckhardti sp. n.
Eusteniamorpha monoglobus sp. n.
Eusteniamorpha anteopacissima sp. n.
Eusteniamorpha incongruens sp. n.
Eusteniamorpha geniculata sp. n.
Eusteniamorpha vitreipes sp. n.
Eusteniamorpha triangulum sp. n.
Eusteniamorpha borneensis Cameron, 1920
Eusteniamorpha sabahensis sp. n.
Eusteniamorpha bulbosa sp. n.
Eusteniamorpha polita sp. n.
Eusteniamorpha magnatheca sp. n.
Eusteniamorpha variabilis sp. n.
Eusteniamorpha eleganticollis sp. n.
Eusteniamorpha kinabaluensis sp. n.
Eusteniamorpha muluicola sp. n.

AUTALIINI Thomson, 1859
Autalia kinabaluensis sp. n.

DESCRIZIONI

Eusteniamorpha strictipennis sp. n. Figg. 1-4

Holotypus ♂, Sabah, Crocker Ra., 1200 m, Km 63 r.te Kota Kinabalu-Tambunan, 19.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 9 es., stessa provenienza.

DESCRIZIONE. Lungh. 1,1 mm. Capo e pronoto opachi, parte restante lucida. Corpo rossiccio, antenne rossicce con l'undicesimo antennomero giallo; zampe giallo-rossicce. La granulosità del capo e del pronoto è fittissima, tanto da dare un aspetto rugoso alla superficie. La granulosità delle elitre e dell'addome è distinta. Il solco mediano del pronoto è poco profondo. Edeago figg. 2-3, spermateca fig. 4.

COMPARAZIONI. Tutte le ventiquattro specie del genere *Eusteniamorpha* a me note sui tipi, provenienti dagli arcipelaghi e isole intorno al Borneo, non presentano elitre più strette e molto più corte del pronoto. E' il primo caso di specie attera e di taglia corporea ridottissima, nell'ambito del genere *Eusteniamorpha.*

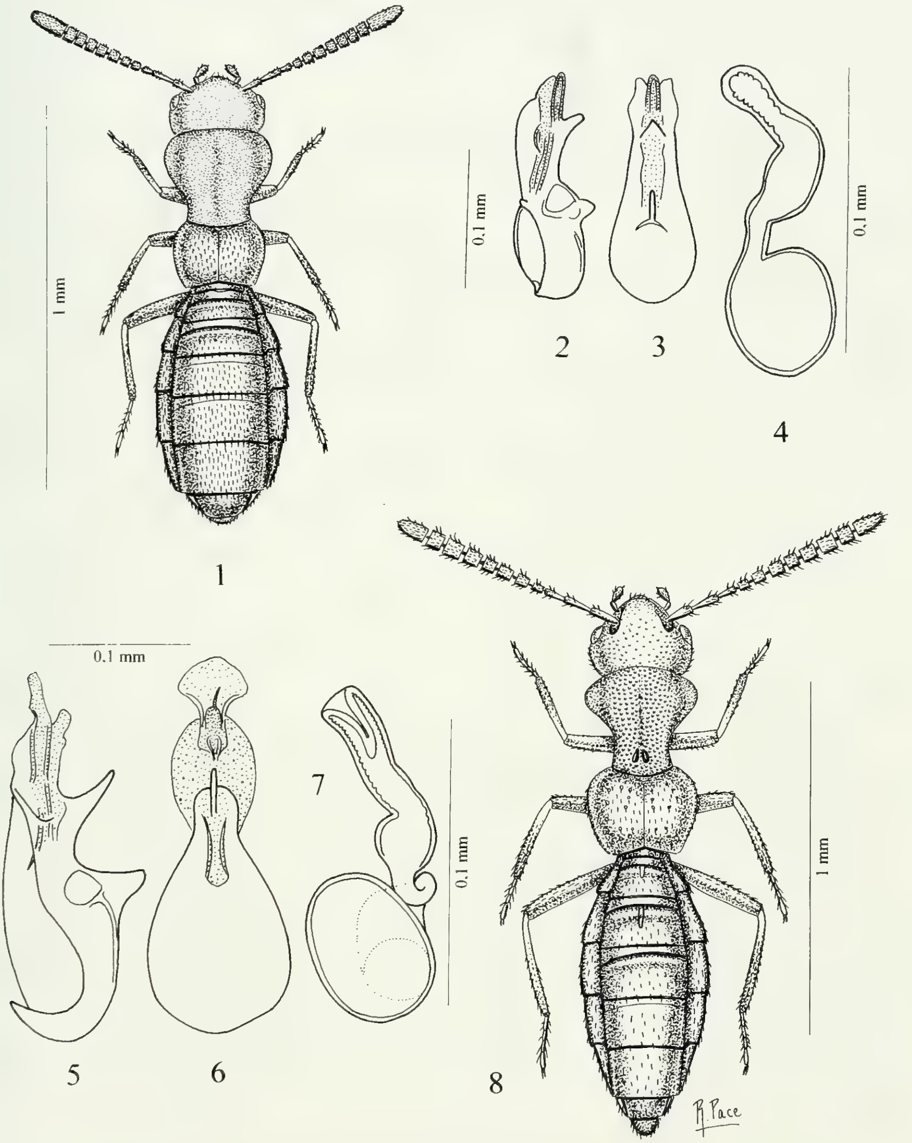
ETIMOLOGIA. Il nome della nuova specie significa "Dalle elitre strette".

Eusteniamorpha introflexa sp. n. Figg. 5-8

Holotypus ♀, Borneo-Sabah, M. Kinabalu N.P., Summit Trail, 1890 m, (data di cattura mancante), leg. A. Smetana (MHNG).

Paratypi: 11 es., Borneo-Sabah, Mt. Kinabalu N.P., 1900 m, 26.IV.1987, leg. Burckhardt & Löbl; 1 ♀, Sabah, Kibongo V., 7 Km N Tambunan, 700 m, 20.IV.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,7 mm. Corpo lucido, con pronoto opaco, e giallo sporco, antenne e zampe gialle. La granulosità della fascia mediana del capo è distinta e non fitta, quella ai lati è fittissima. La granulosità del pronoto è fittissima, tranne ai lati dove si trovano granuli isolati, quella dell'addome è distinta. La punteggiatura delle elitre è forte e rada. Edeago figg. 5-6, spermateca fig. 7.



Figg. 1-8

Habitus, edeago in visione laterale e ventrale e spermateca. 1-4: *Eusteniamorpha strictipennis* sp. n.; 5-8: *Eusteniamorpha introflexa* sp. n.

Comparazioni. La nuova specie presenta una spermateca di forma simile a quella di *E. livida* Bernhauer, 1928, delle Filippine, e di *E. opacicollis* (Fauvel, 1905), della Birmania. La forma di quest'organo potrebbe indicare un'affinità fra le tre specie. Tuttavia, la nuova specie è nettamente differente, per avere il pronoto molto sviluppato e le elitre ridotte, oltre per la diversa forma dell'edeago.

ETIMOLOGIA. La profonda introflessione apicale del bulbo distale della spermateca dà il nome alla nuova specie.

Eusteniamorpha subtiliapex sp. n. Figg. 9-11

Holotypus ♂, Sabah, Crocker Ra., 1270 m, Km 60 r.te Kota Kinabalu-Tambunan, 17.V.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE. Lungh. 1,7 mm. Capo e pronoto opachi, resto del corpo lucido. Corpo rossiccio con elitre, tranne la base, e uriti liberi terzo e quarto bruni; antenne rossicce con l'undicesimo antennomero giallo; zampe giallo-rossicce. La granulosità del capo è fittissima, tranne sulla fronte dove è rada, quella del pronoto è altrettanto fitta, distribuita su tutta la superficie. Le elitre mostrano una grossolana punteggiatura rada. Sul corpo non vi è la presenza di reticolazione. Edeago figg. 10-11.

COMPARAZIONI. Anche *E. rufa* Cameron, 1920, di Singapore, ha l'apice dell'edeago stretto e lungo, come quello della nuova specie, ma la forma complessiva di quest'organo è chiaramente differente. Quello di *E. rufa* ha un'evidente gibbosità ventrale, *crista apicalis* enormemente sviluppata e manca di robustissima armatura interna, presente, invece, all'interno dell'edeago della nuova specie. Inoltre, il capo di *E. rufa* è punteggiato, mentre quello della nuova specie è coperto di granulosità fitta, che sulla fronte si fa rada.

ETIMOLOGIA. La nuova specie prende nome dall'apice sottile del suo edeago.

Eusteniamorpha deiectorum sp. n. Figg. 12-15

Holotypus ♂, Sabah, Poring Hot Springs, Langanan Falls, 900-950 m, 12.V.1987, leg. Burckhardt & Löbl (MHNG).

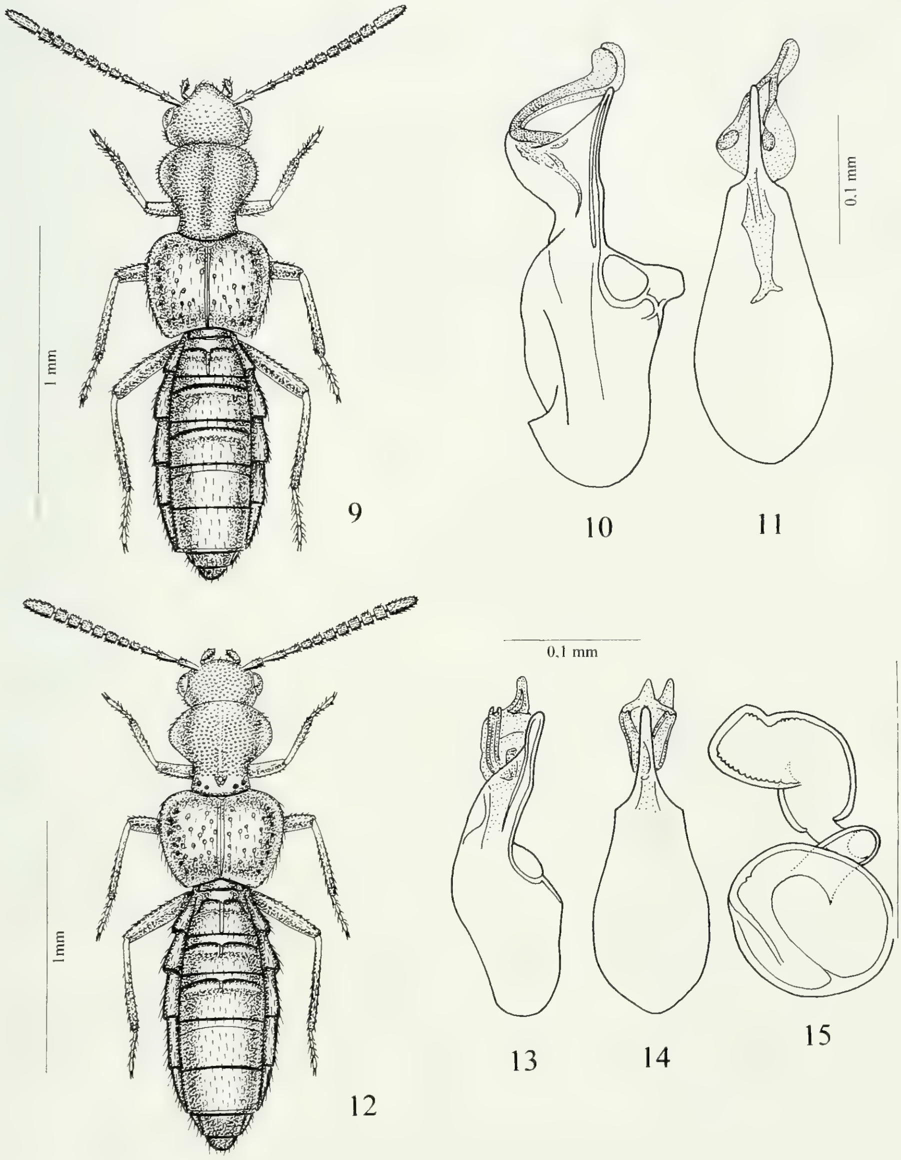
Paratypus: 1 ♀, Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 485 m, 29.VIII. 1988, leg. A. Smetana.

DESCRIZIONE. Lungh. 1,9 mm. Capo e pronoto debolmente opachi, resto del corpo lucido. Corpo bruno-rossiccio; antenne rossicce, zampe giallo-rossicce. La granulosità del capo è fittissima e distribuita su tutta la superficie, quella del pronoto è pure fittissima, ma assente alla base e quella dell'addome è superficiale. La punteggiatura delle elitre è grossolana e rada. Non vi è traccia di reticolazione. Edeago figg. 13-14, spermateca fig. 15.

COMPARAZIONI. Questa specie, a un'osservazione superficiale, sembra molto simile a *E. subtiliapex* sp. n., sopra descritta. Se ne distingue per i caratteri dati nella seguente chiave.

1 Undicesimo antennomero giallo; fronte con granulosità rada; granulosità del pronoto estesa fino alla base, dove non sono presenti punti; fossetta mediana basale del pronoto assente; armatura genitale interna dell'edeago assai sviluppata. Lungh. 1,7 mm. . . . . *E. subtiliapex* sp. n.

- Undicesimo antennomero rossiccio; fronte con granulosità fitta; granulosità del pronoto assente su una fascia basale, su cui si trovano quattro punti profondi; fossetta mediana basale del pronoto presente; armatura genitale interna dell'edeago poco sviluppata. Lungh. 1,9 mm. . . . . *E. deiectorum* sp. n.



FIGG. 9-15
Habitus, edeago in visione laterale e ventrale e spermateca. 9-11: *Eusteniamorpha subtiliapex* sp. n.; 12-15: *Eusteniamorpha deiectorum* sp. n.

ETIMOLOGIA. Dato che la nuova specie è stata raccolta alle *Langanan Falls,* essa prende nome da queste cascate.

Eusteniamorpha burckhardti sp. n. Figg. 16-19

Holotypus ♀, Sabah, Crocker Ra., 1350 m, Km 60 Kota Kinabalu-Tambunan, 17.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 2 ♂♂, stessa provenienza.

Descrizione. Lungh. 1,2 mm. Pronoto opaco, resto del corpo lucido. Corpo giallo sporco; antenne di un giallo sporco, con antennomero basale e l'undicesimo gialli; zampe gialle. La granulosità del capo è fitta, quella delle elitre è saliente e quella dell'addome è fine. Il pronoto è coperto di rugosità e ha un solco poco profondo. Non è presente reticolazione sul corpo. Edeago fig. 17-18, spermateca fig. 19.

Comparazioni. La caratteristica forma della spermateca della nuova specie, cioè con parte spiralata tra i due bulbi, distale e prossimale, ricorda da vicino quella di *E. punctipennis* Bernhauer, 1928, delle Filippine, e forse indica una stretta affinità tra le due specie. Tuttavia, esse sono tra loro ben distinte, perché la parte a spirale della spermateca di *punctipennis* è molto più sviluppata di quella della nuova specie. Inoltre il quarto antennomero è trasverso nella nuova specie e più lungo che largo in *punctipennis,* e il pronoto della nuova specie non è sinuato davanti agli angoli posteriori, mentre quello di *punctipennis* è accentuatamente sinuato.

Etimologia. La nuova specie è dedicata a uno dei suoi raccoglitori, il Dr. Daniel Burckhardt, attualmente del Museo di Storia Naturale di Basilea.

Eusteniamorpha monoglobus sp. n. Figg. 20-21

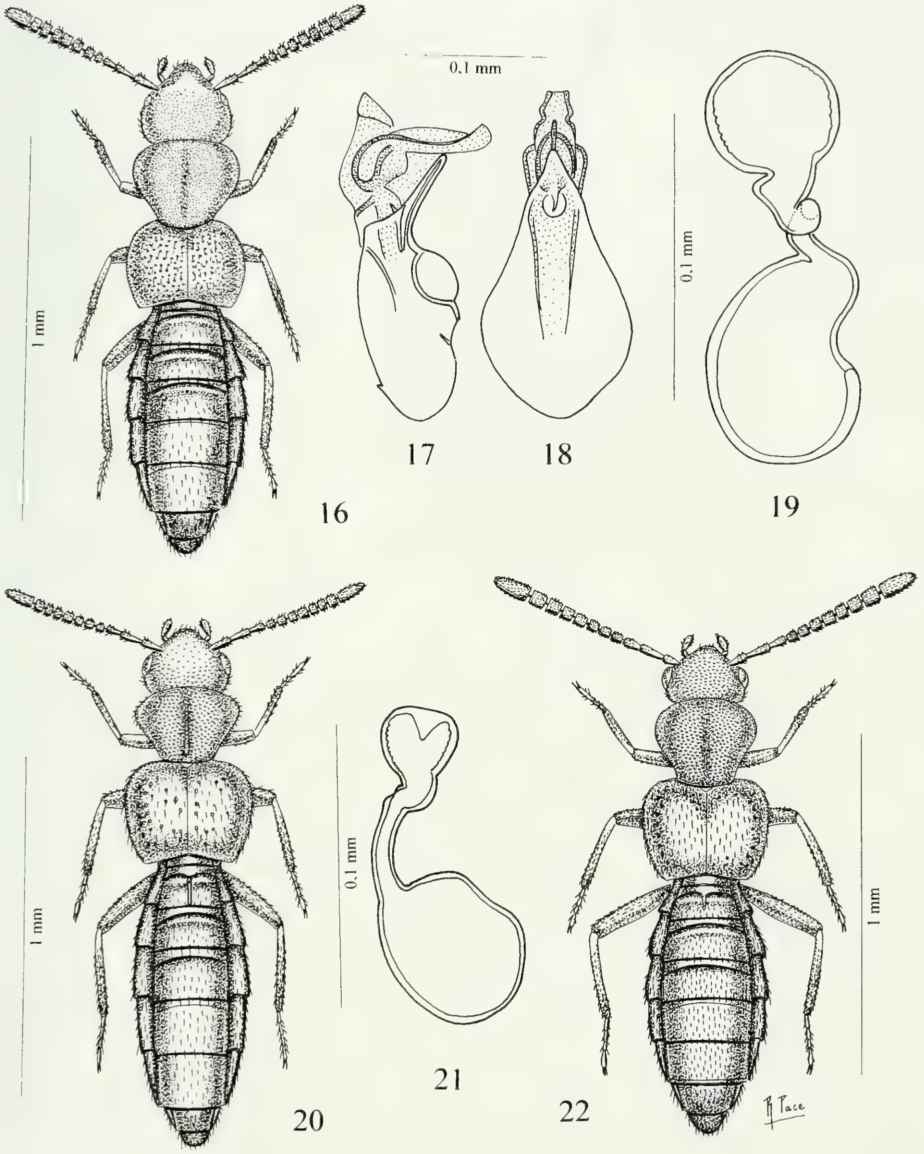
Holotypus ♀, Borneo-Sabah, Mt. Kinabalu, Poring Hot Springs, 490 m, 31.VIII.1988, leg. A. Smetana (MHNG).

Descrizione. Lungh. 1,4 mm. Capo e pronoto opachi, resto del corpo lucido. Corpo bruno-rossiccio con elitre brune; antenne brune con l'antennomero basale e l'undicesimo giallo-rossicci; zampe gialle. La granulosità del capo è fittissima, ma sulla fronte e sul disco è diradata. La granulosità del pronoto è fittissima e lievemente diradata a ciascun lato, quella dell'addome è densa. Il solco mediano del pronoto è largo e profondo. La punteggiatura delle elitre è forte e rada, ma infittita al lato esterno di ciascuna elitra. Sul corpo non vi è reticolazione. Spermateca fig. 21.

Comparazioni. A un'osservazione superficiale, questa nuova specie sembra uguale a *E. burckhardti* sp. n. sopra descritta. L'assenza di spira tra i due bulbi della spermateca è un carattere differenziale notevole. Altre differenze notevoli sono date nella seguente chiave.

1 Occhi ridotti, molto più corti delle tempie; solco mediano del pronoto superficiale; primo urotergo libero senza carena mediana; bulbo distale della spermateca più sviluppato, nonostante la taglia corporea minore, e senza introflessione apicale. Lungh. 1,2 mm . . . . *E. burckhardti* sp. n.

- Occhi bene sviluppati, lunghi quanto le tempie; solco mediano del pronoto profondo; primo urotergo libero con carena mediana; bulbo distale della spermateca poco sviluppato, nonostante la taglia corporea maggiore, e con profonda introflessione apicale. Lungh. 1,4 mm . . . . *E. monoglobus* sp. n.



FIGG. 16-22

Habitus, edeago in visione laterale e ventrale e spermateca. 16-19: *Eusteniamorpha burckhardti* sp. n.; 20-21: *Eusteniamorpha monoglobus* sp. n.; 22: *Eusteniamorpha anteopacissima* sp. n.

ETIMOLOGIA. Il nome della nuova specie significa "Un solo globo" in riferimento al bulbo prossimale della spermateca e in contrapposizione a quello di *E. geniculata* n. sp, sotto descritta, che ha il bulbo prossimale composto da due globi fusi tra loro.

Eusteniamorpha anteopacissima sp. n. Figg. 22-24

Holotypus ♂, Sabah, Crocker Ra., 1200 m, Km 63 rte Kota Kinabalu-Tambunan, 19.V.1987, leg. Burckhardt & Löbl (MHNG).

Descrizione. Lungh. 1,4 mm. Capo e pronoto molto opachi, parte restante del corpo lucida. Corpo bruno con elitre nero-brune, addome giallo-bruno con uriti liberi terzo e quarto bruni; antenne bruno-rossicce con i tre quarti apicali dell'undicesimo gialli. La granulosità del capo e del pronoto è fittissima, anche sulla fronte, quella dell'addome è fine e fitta. La punteggiatura delle elitre è presente solo ai lati e alla base. Edeago figg. 23-24.

Comparazioni. Per la forma dell'edeago e per l'habitus simili, la nuova specie è tassonomicamente molto vicina a *E. javanensis* Pace, 1993, di Giava. Se ne distingue per i caratteri dati nella seguente chiave

1 Undicesimo antennomero interamente rossiccio; pronoto senza granulosità ai lati; sinuosità laterale del pronoto accentuata; primo urotergo libero con una carena mediana lunga fino al margine posteriore; secondo urotergo libero con breve carena mediana basale; addome giallo-rossiccio; "crista apicalis" dell'edeago più sviluppata e sporgente; edeago largo all'estremità, in visione ventrale. Lungh. 1,5 mm
. . . . *E. javanensis* Pace

- Undicesimo antennomero giallo con base rossiccia; pronoto granuloso anche ai lati; sinuosità laterale del pronoto debolissima; primo urotergo libero con una carena mediana corta, non raggiungente il margine posteriore; secondo urotergo libero senza carena mediana; addome giallo-bruno, con una fascia bruna; "crista apicalis" dell'edeago ridotta e non sporgente; edeago stretto all'estremità, in visione ventrale. Lungh. 1,4 mm . . . . *E. anteopacissima* sp. n.

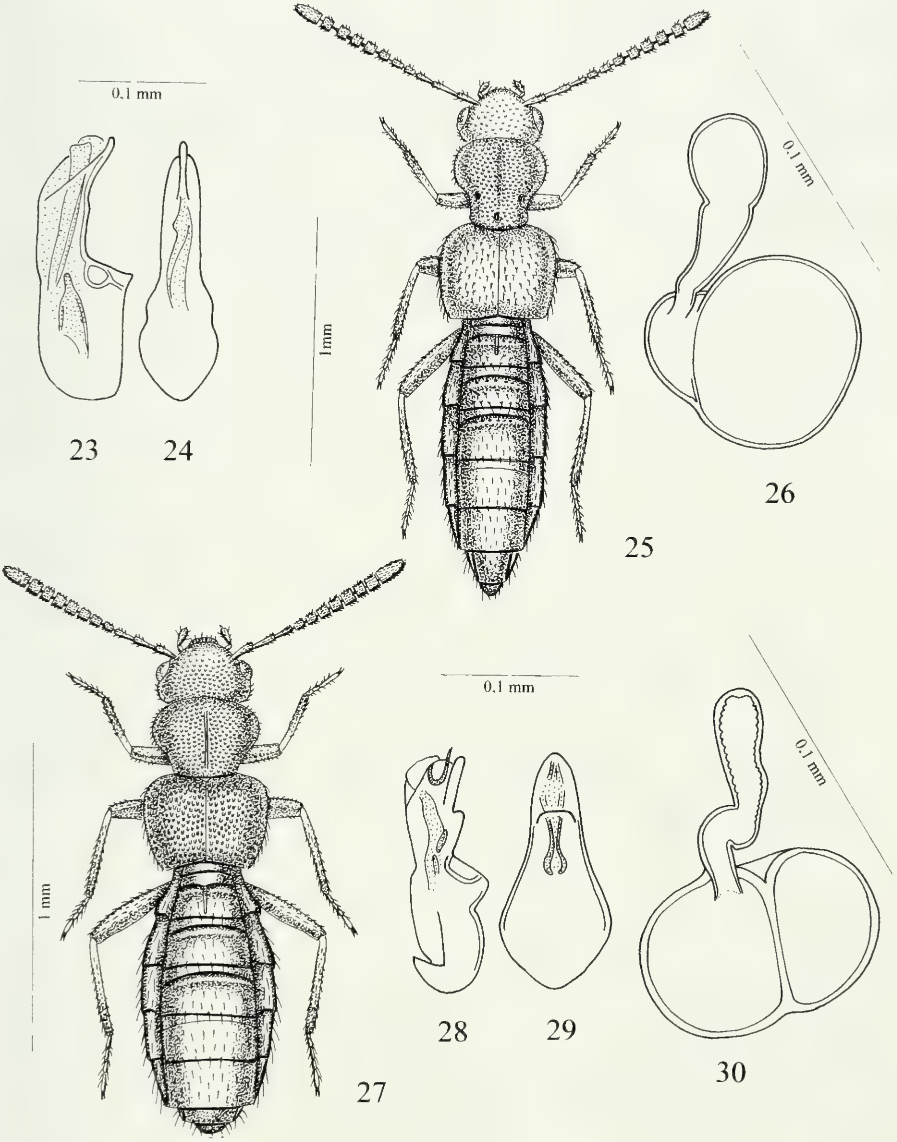
Etimologia. Dato che la nuova specie presenta capo e pronoto assai opachi è chiamata "Molto opaca davanti".

Eusteniamorpha incongruens sp. n. Figg. 25-26

Holotypus ♀, Borneo-Sabah, Mt. Kinabalu N.P., below Layang Layang, 2590 m, 1.V.1987, leg. A. Smetana (MHNG).

Descrizione. Lungh. 2,0 mm. Corpo interamente lucido e bruno-rossiccio; antenne bruno-rossicce con i due antennomeri basali e l'undicesimo gialli; zampe giallo-rossicce. La granulosità del capo, addome ed elitre è molto saliente, quella del pronoto è diradata ai lati, quella dei due uroterghi liberi basali è saliente e quella dei restanti uroterghi è superficiale. Spermateca fig. 26.

Comparazioni. Senza l'esame della spermateca, questa nuova specie sarebbe determinabile come *E. opacicollis* (Fauvel, 1905) della Birmania, anche se la taglia corporea è maggiore nella nuova specie e il pronoto meno trasverso. La spermateca nelle due specie è del medesimo tipo, cioè con bulbo basale assai dilatato. Ma la nuova specie ha bulbo distale subsferico, senza profonda introflessione apicale, questa



FIGG. 23-30

Edeago in visione laterale e ventrale, habitus e spermateca. 23-24: *Eusteniamorpha anteopacissima* sp. n.; 25-26: *Eusteniamorpha incongruens* sp. n.; 27-30: *Eusteniamorpha geniculata* sp. n.

invece presente nel bulbo distale della spermateca di *E. opacicollis*, che è inoltre subcilindrico.

ETIMOLOGIA. Il nome della nuova specie significa "Sconveniente" a motivo della difficoltà di determinazione, essendo varie le specie con habitus simile.

Eusteniamorpha geniculata sp. n. Figg. 27-29

Holotypus ♀, Borneo-Sabah, Mt. Kinabalu Nat. Pk., HQ 1560 m, 23.IV.1987, leg. A. Smetana (MHNG).

Paratypi: 1 ♀, Borneo-Sabah, Mt. Kinabalu Nat. Pk., Int. trap., HQ 1500 m, 30.IV-8.V.1987, leg. A. Smetana; 4 ♂♂ e 1 ♀, Borneo-Sabah, Mt. Kinabalu,1500 m, 25.IV.1987, leg. Burckhardt & Löbl; 1 ♂ e 1 ♀, Borneo-Sabah, E Mt. Kinabalu,1150 m, rte. Ranau-Kota Kinabalu, 24.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,7 mm. Avancorpo opaco, addome lucido. Corpo bruno con quarto urite libero nero-bruno; antenne bruno-rossicce con i due antennomeri basali e l'undicesimo giallo-rossicci; zampe gialle, con femori medi e posteriori bruni, tranne le ginocchia. La granulosità del capo, pronoto ed elitre è fittissima e molto saliente, ma sulla fronte è diradata e quella delle elitre è composta di granuli lievemente allungati. La granulosità dell'addome è superficiale e rada. Sul corpo non vi è reticolazione. Edeago figg. 28-29, spermateca fig. 29.

COMPARAZIONI. Questa nuova specie, in base alla forma della spermateca, a un'osservazione superficiale, è confondibile con *E. incongruens* sp. n. sopra descritta. Se ne distingue per i caratteri dati nella seguente chiave.

1 Pronoto appena più lungo che largo, con superficie laterale a granulosità rada; elitre coperte di granulosità poco fitta; bulbo distale della spermateca globulare. Lungh. 2,0 mm . . . . *E. incongruens* sp. n.

- Pronoto molto trasverso, con superficie uniformemente granulosa; elitre coperte di granulosità fitta e a granuli allungati; bulbo distale della spermateca allungato e stretto. Lungh. 1,7 mm . . . . *E. geniculata* sp. n.

ETIMOLOGIA. Il nome della nuova specie significa "Colei che ha il ginocchio", a motivo della curvatura, simile a ginocchio flesso, della parte mediana della spermateca dell'holotypus.

Eusteniamorpha vitreipes sp. n. Figg. 31-32

Holotypus ♀, Sabah, Mt. Kinabalu,1750 m, 27.IV.1987, leg. Burckhardt & Löbl (MHNG).

DESCRIZIONE. Lungh. 1,7 mm. Avancorpo opaco, parte restante lucida. Corpo bruno con uriti liberi terzo e quarto nero-bruni; antenne brune con l'antennomero basale e l'undicesimo giallo-rossicci; zampe gialle con femori medi e posteriori bruni, tranne le ginocchia. La granulosità del capo, pronoto ed elitre è fitta e forte, quella delle elitre è composta di granuli allungati. Il solco mediano del pronoto è fine e non infossato. Spermateca fig. 32.

COMPARAZIONI. In base alla forma della spermateca, la nuova specie sembra tassonomicamente vicina a *E. geniculata* sp. n. e a *E. incongruens* sp. n., entrambe sopra descritte, ma in quest'organo manca il tubulo tra bulbo distale e quello prossimale. Inoltre il pronoto della nuova specie non è snello come quello di *incongrüens,* né fortemente dilatato come quello di *E. geniculata.*

ETIMOLOGIA. Le tibie e i tarsi della nuova specie sono gialli e trasparenti come vetro, pertanto è chiamata "Dalle zampe di vetro". Tuttavia, va osservato che tutte le specie del genere *Eusteniamorpha,* almeno quelle di taglia corporea ridotta, presentano zampe trasparenti, carattere verificabile ponendo uno spillino entomologico nero dietro una tibia.

Eusteniamorpha triangulum sp. n Figg. 33-36

Holotypus ♂, Sabah, Poring Hot Springs, 500 m, 7.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 12 es., stessa provenienza; 1 ♂ e 1 ♀, Borneo-Sabah, Mt. Kinabalu, Poring Hot Springs, 500 m, 13.V.1987, leg. Burckhardt & Löbl; 1 ♀, Borneo-Sabah, Mt. Kinabalu, 1750 m, 27.IV.1987, leg., Burckhardt & Löbl; 1 ♀, Borneo-Sabah, Mt. Kinabalu,1150 m, rte. Ranau-Kota Kinabalu, 24.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,6 mm. Capo e pronoto opachi, resto del corpo lucido. Corpo rossiccio sporco; antenne rossicce; zampe giallo-rossicce. La granulosità del capo e del pronoto è fittissima, ma è diradata sul disco del capo e ai lati del pronoto. La granulosità dell'addome è fitta e fine. La punteggiatura delle elitre è rada, grossolana e irregolarmente distribuita, su un fondo privo di reticolazione. Edeago figg. 34-35, spermateca fig. 36.

COMPARAZIONI. La nuova specie è tassonomicamente vicina a *E. opacicollis* (Fauvel) della Birmania, a motivo della forma dell'habitus, dell'edeago e della spermateca. Se ne distingue per i caratteri dati nella seguente chiave.

1 Quarto antennomero più lungo che largo; capo uniformemente granuloso; base del pronoto con sei punti ; uroterghi liberi primo e secondo con cortissima carena mediana basale; apice dell'edeago, in visione ventrale, strettissimo e dilatato a paletta rotonda all'estremità. Lungh. 1,6 mm. Birmania . . . . *E. opacicollis* (Fauvel)

- Quarto antennomero trasverso; disco del capo con granuli radi; base del pronoto senza punti ; solo il primo urotergo libero con carena mediana basale, che si estende dalla base al margine posteriore dello stesso urotergo; apice dell'edeago, in visione ventrale, largamente arrotondato all'estremità. Lungh. 1,6 mm. Birmania . . . . *E. triangulum* sp. n.

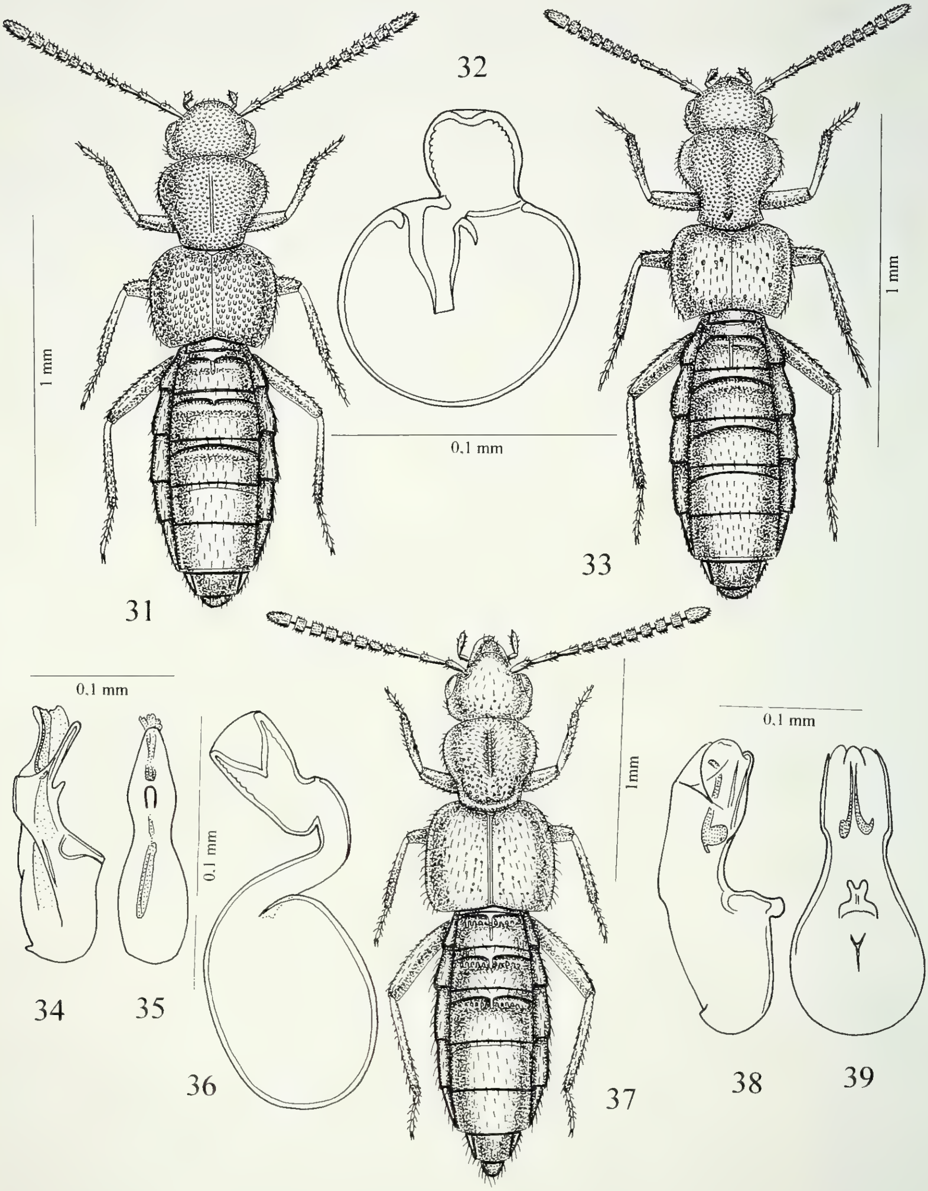
ETIMOLOGIA. Dato che l'introflessione apicale del bulbo distale della spermateca ha forma di triangolo in sezione (in realtà è un cono), la nuova specie prende il nome di "Triangolo".

Eusteniamorpha sabahensis sp. n. Figg. 40-43

Holotypus ♂, Sabah, Mt. Kinabalu, 1750 m, 27.IV.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 23 es., stessa provenienza; 1 es., Sabah, Mt. Kinabalu, 1750 m, 21.IV.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh.1,6 mm. Corpo lucido e rossiccio; antenne giallo-rossicce; zampe gialle. La punteggiatura del capo è superficiale e poco densa, assente sulla fascia mediana. La granulosità del pronoto è distinta e rada, quella delle elitre e dell'addome è fine e poco densa. Il solco mediano del pronoto è profondo e allargato posteriormente. Non si osserva reticolazione sul corpo. Edeago figg. 41-42, spermateca fig. 43.



FIGG. 31-39

Habitus, spermateca ed edeago in visione laterale e ventrale. 31-32: *Eusteniamorpha vitreipes* sp. n.; 33-36: *Eusteniamorpha triangulum* sp. n.; 37-39: *Eusteniamorpha borneensis* Cameron, holotypus ♂.

COMPARAZIONI. La nuova specie, per la forma della spermateca e per alcuni caratteri esterni del corpo, può essere affine a *E. livida* Bernhauer, 1928, delle Filippine, di cui, però, è noto il solo esemplare olotipo ♀. Se ne distingue per i caratteri dati nella seguente chiave.

1 Capo coperto di granulosità fitta e saliente; granulosità del pronoto saliente e fittissima; base del pronoto senza punti forti; primo urotergo libero con carena mediana; introflessione apicale del bulbo distale della spermateca, assai profonda. Lungh. 1,3 m. Filippine ..... *E. livida* Bernhauer

- Capo coperto di punteggiatura superficiale poco densa; granulosità del pronoto distinta e rada; base del pronoto con sei punti forti; primo urotergo libero senza carena mediana; introflessione apicale del bulbo distale della spermateca, appena sporgente. Lungh.1,6 m. Borneo .... *E. sabahensis* sp. n.

ETIMOLOGIA. La nuova specie prende nome dal Sabah.

Eusteniamorpha bulbosa sp. n. Figg. 44-47

Holotypus ♂, Sabah, Crocker Ra., 1200 m, Km 63 rte Kota Kinabalu-Tambunan, 19.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 11 es., Borneo-Sabah, Crocker Ra., 1200-1350 m, Km 63 r.te Kota Kinabalu-Tambunan, 17-19.IV.1987, leg. Burckhardt & Löbl; 1 ♂, Sabah, Poring Hot Springs, Langanan Falls, 900-950 m, 12.V.1987, leg. Burckhardt & Löbl; 3 es., Sabah, Poring Hot Springs, 500 m, 8.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,7 mm. Corpo interamente lucido e rossiccio, con capo bruno-rossiccio; antenne giallo-rossicce; zampe gialle. La granulosità del capo è fitta, ma superficiale e rada sulla fascia mediana, quella del pronoto è distinta e abbastanza densa, ma molto rada ai lati fino alla base. La punteggiatura delle elitre è composta da alcuni punti isolati e poco distinti. Edeago figg. 45-46, spermateca fig. 47.

COMPARAZIONI. La nuova specie è simile a *E. triangulum* sp. n. sopra descritta, ma distinta per l'edeago molto più largo al livello del bulbo basale e per la debole introflessione apicale del bulbo distale della stessa spermateca (assai profonda in *triangulum*).

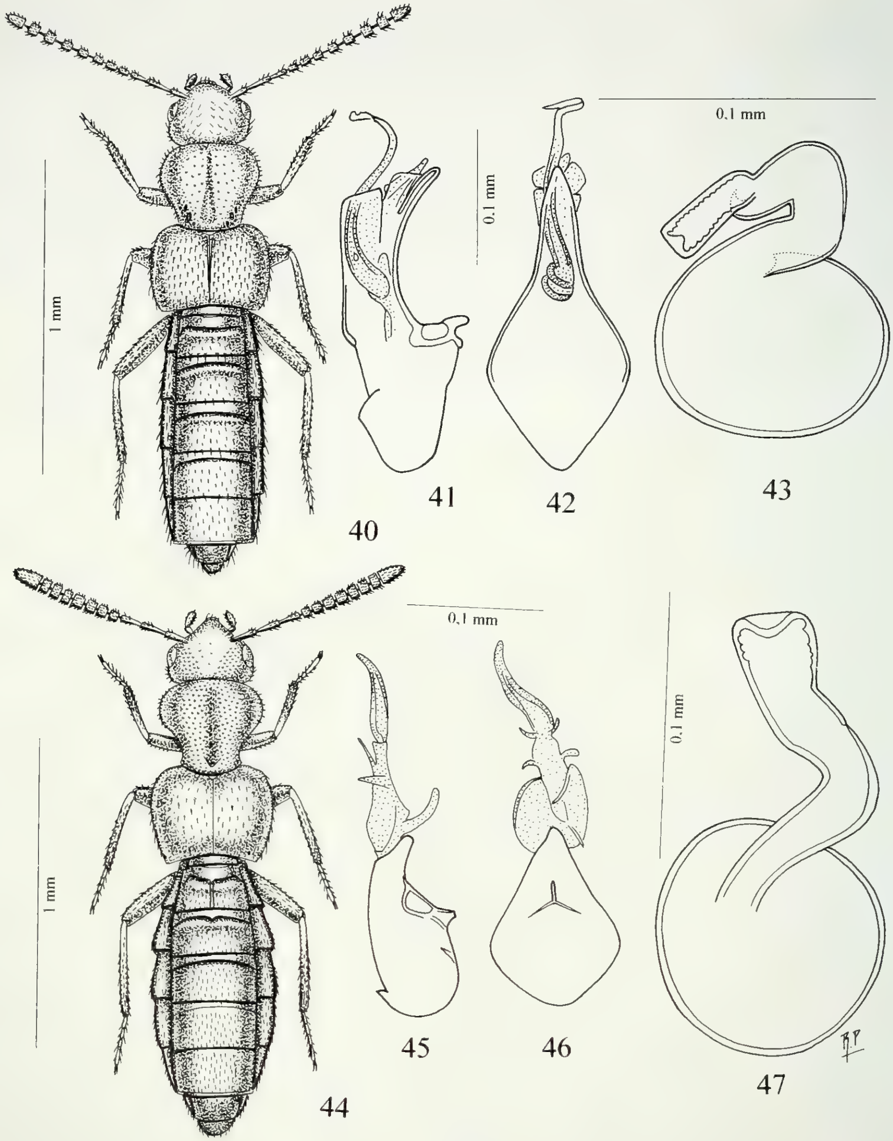
ETIMOLOGIA. Il bulbo basale della spermateca della nuova specie, essendo particolarmente sviluppato ha suggerito il nome di "Bulbosa".

Eusteniamorpha polita sp. n. Figg. 48-51

Holotypus ♀, Borneo-Sabah, Mt. Kinabalu Nat. Pk., HQ 1560-1660 m, 24.IV.1987, leg. A. Smetana (MHNG).

Paratypi: 2 ♀♀, Borneo-Sabah, Mt. Kinabalu Nat. Pk., HQ Silau-Silau Tr., 1560 m, 3.VIII.1988, leg. A. Smetana; 1 ♀, Borneo-Sabah, Mt. Kinabalu N. P., Headquarters, 1558 m, 2-4..IX.1988, large fallen tree *Lithocarpus* sp., D.E. Bright collector; 1 ♂, Sabah, Mt. Kinabalu, 1750 m, 27.IV.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,9 mm. Corpo lucido e bruno; antenne e zampe giallo-rossicce. La granulosità del capo è poco distinta, quella del pronoto e delle elitre è molto superficiale e quella dell'addome è fine e distinta. Il pronoto mostra una netta



FIGG. 40-47

Habitus, edeago in visione laterale e ventrale e spermateca. 40-43: *Eusteniamorpha sabahensis* sp. n.; 44-47: *Eusteniamorpha bulbosa* sp. n.

punteggiatura solo a ciascun lato del solco mediano, ma non in avanti. Sul corpo non vi è traccia di reticolazione. Edeago figg. 49-50, spermateca fig. 51.

COMPARAZIONI. La nuova specie è affine a *E. borneensis* Cameron, 1933, per il fatto che presenta il pronoto in gran parte non punteggiato e non granuloso. Se ne distingue per i caratteri dati nella seguente chiave.

1 Decimo antennomero chiaramente trasverso; capo nettamente punteggiato; base del pronoto con un solco ampiamente arcuato; punteggiatura delle elitre netta; i tre uroterghi liberi basali con carena mediana; edeago figg. 38-39. Lungh. 2,5 mm . . . . *E. borneensis* Cameron

2 Decimo antennomero appena trasverso; capo coperto di granulosità poco distinta; base del pronoto con una grande fossetta mediana posteriore divisa anteriormente; punteggiatura delle elitre assente, sostituita da granulosità molto superficiale; solo il primo urotergo libero basale con carena mediana; edeago figg. 49-50. Lungh. 1,9 mm . . . . . . *E. polita* sp. n.

ETIMOLOGIA. Poiché il pronoto della nuova specie è per lo più privo di punteggiatura e di granulosità, essa prende il nome di "Polita o Levigata".

Eusteniamorpha magnatheca sp. n. Figg. 52-55

Holotypus ♀, Sabah, Kibongol V., 7 Km N Tambunan, 700 m, 20.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 11 es., stessa provenienza.

DESCRIZIONE. Lungh. 1,4 mm. Corpo lucido e bruno rossiccio, con elitre brune, tranne la base; antenne rossicce con metà apicale dell'undicesimo giallo; zampe giallo-rossiccio. La granulosità del capo e del pronoto è fitta, assente sulla fronte ed estesa su tutto il pronoto, anche ai lati. La punteggiatura delle elitre è netta e irregolarmente distribuita. Sul corpo non vi è traccia di reticolazione. Edeago figg. 53-54, spermateca fig. 55.

COMPARAZIONI. La nuova specie è affine e distinta da *E. variabilis* sp. n., sotto descritta, per i caratteri dati nella seguente chiave.

1 Granulosità del pronoto estesa anche ai lati; elitre più corte del pronoto; bulbo distale della spermateca ellittico assai allungato, senza introflessione apicale. Lungh. 1,4 mm . . . . *E. magnatheca* sp. n.

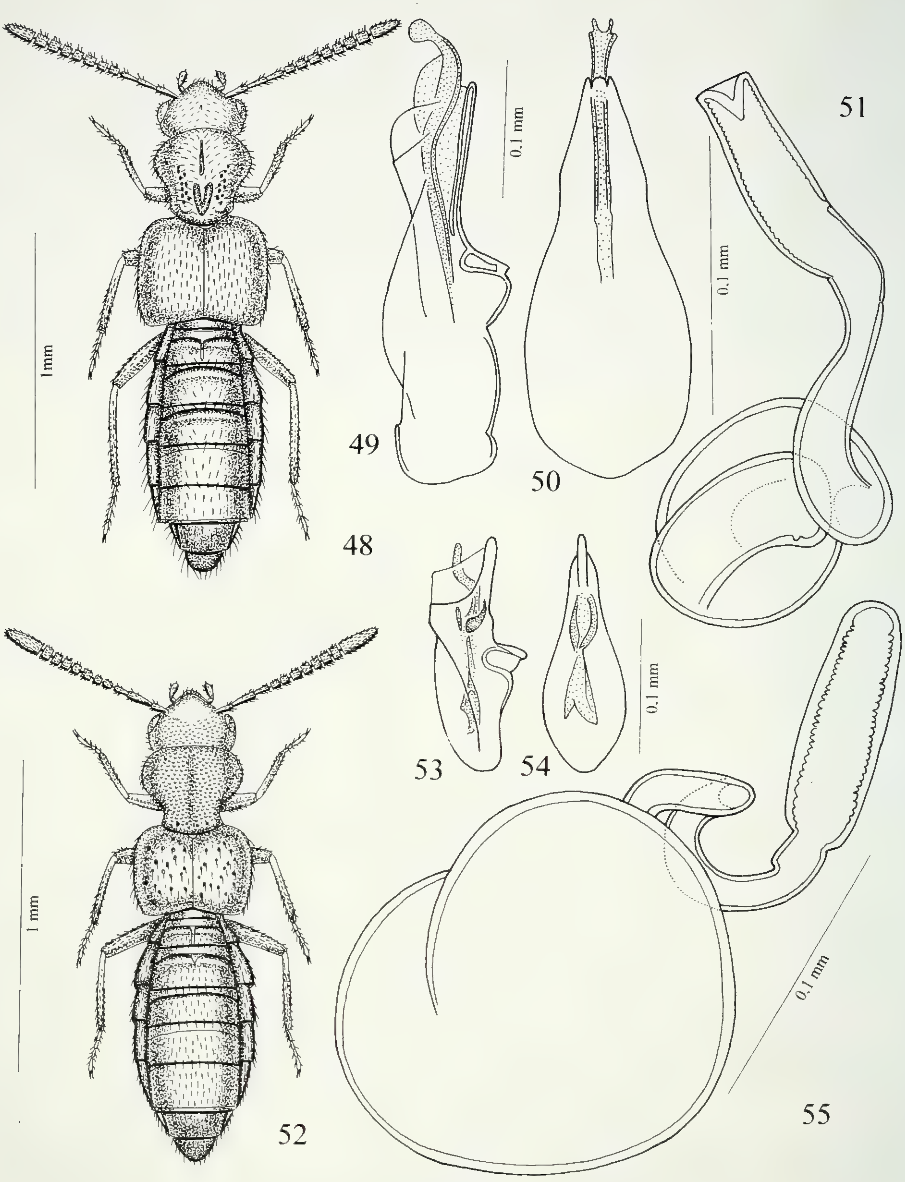
- Granulosità del pronoto assente ai lati; elitre più lunghe del pronoto; bulbo distale della spermateca cilindrico, con introflessione apicale emisferica. Lungh. 1,4 mm . . . . *E. variabilis* sp. n.

ETIMOLOGIA. Il grande sviluppo in grandezza della spermateca è il motivo per cui la nuova specie prende nome di "Grande spermateca".

Eusteniamorpha variabilis sp. n. Figg. 56-61

Holotypus ♂, Sabah, Poring Hot Springs, Langanan river, 850 m, 14.V.1987, leg. Burckhardt & Löbl (MHNG).

Paratypi: 15 es., Sabah, Poring Hot Springs, Langanan river, 850-950 m, 14.V.1987, leg. Burckhardt & Löbl; 1 ♂, Sabah, Poring Hot Springs, 850 m, 14.V.1987, leg. Burckhardt & Löbl; 2 ♂♂, Sabah, Poring Hot Springs, 500 m, 7.V.1987, leg. Burckhardt & Löbl; 2 ♂♂, Borneo-Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 31.VIII.1988, leg. A. Smetana; 7 es., Sabah, Poring Hot Springs, nr. Bat Cave, 600 m, 10.V.1987, leg. Burckhardt & Löbl; 6 es., Sabah, Poring Hot Springs, 550-600 m, 9.V.1987, leg. Burckhardt & Löbl; 1 ♂, Borneo-Sabah, Mt. Kinabalu, 1550 m, 29.IV.1987, leg. Burckhardt & Löbl.



FIGG. 48-55

Habitus, edeago in visione laterale e ventrale e spermateca. 48-51: *Eusteniamorpha polita* sp. n.; 52-55: *Eusteniamorpha magnatheca* sp. n.

DESCRIZIONE. Lungh. 1,7 mm. Capo e pronoto opachi, resto del corpo lucido. Corpo bruno-rossiccio; antenne giallo-rossicce, con undicesimo antennomero giallo con base rossiccia; zampe giallo-rossicce. La granulosità del capo e del pronoto è saliente e fittissima, assente sulla fronte in triangolo e ai lati del pronoto. La punteggiatura delle elitre è irregolarmente distribuita. La granulosità dell'addome è superficiale. Edeago figg. 56-57, spermateca fig. 61.

COMPARAZIONI. Si veda la chiave data per *E. magnathetca* sp. n., sopra descritta.

ETIMOLOGIA. L'edeago della nuova specie presenta una bozza ventrale, oppure, in sostituzione, una lunga protuberanza: Per questo carattere variabile è stata chiamata appunto "Variabile".

Eusteniamorpha eleganticollis sp. n. Figg. 62-65

Holotypus ♀, Sabah, Mt. Kinabalu, 1500 m, 25.IV.1987, leg. Burckhardt & Löbl (MHNG).

Paratypus: 1 ♂, stessa provenienza.

DESCRIZIONE. Lungh. 1,9 mm. Corpo lucido e bruno-rossiccio, con capo ed elitre bruni; antenne rossicce; zampe gialle. La punteggiatura del capo, del pronoto e delle elitre è profonda e netta, ma assente ai lati del pronoto. L'addome è coperto di una granulosità superficiale. Non si trova reticolazione sul corpo. Edeago figg. 63-64, spermateca fig. 65.

COMPARAZIONI. In base alla forma della spermateca, cioè per la presenza di un bulbo distale seguito da spire fuse tra loro, la nuova specie appartiene a un gruppo differente da quello attribuito a tutte le specie sopra descritte, tranne quelle di cui non è nota la spermateca. Essa si mostra perciò affine a *E. philippina* Bernhauer, 1928, delle Filippine. Se ne distingue per i caratteri dati nella seguente chiave.

1 Decimo antennomero nettamente trasverso; capo coperto di granulosità assai saliente; pronoto lungo quanto largo e coperto di granulosità simile a quella del capo; è presente una punteggiatura nel solco trasverso basale degli uroterghi liberi secondo e terzo; edeago a punta di lancia strettissima, in visione ventrale; spermateca con alcune spire presso il bulbo prossimale. Lungh. 1,6-1,8 mm. Filippine. .... *E. philippina* Bernhauer

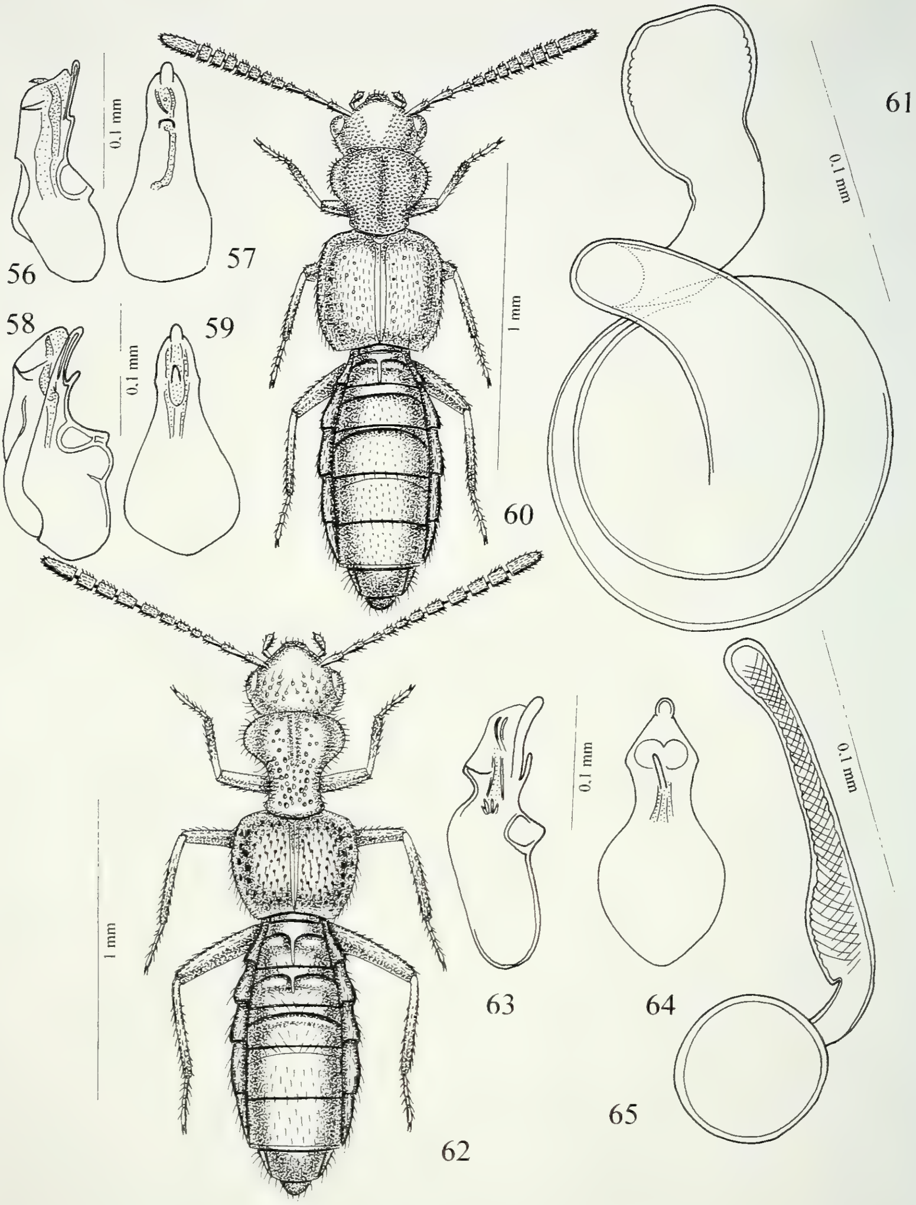
- Decimo antennomero lungo quanto largo; capo coperto di punteggiatura profonda; pronoto più lungo che largo, con robusta punteggiatura a ciascun lato del solco mediano; solchi trasversi basali degli uroterghi senza punteggiatura; edeago a punta triangolare assai larga, in visione ventrale; spermateca senza spire presso il bulbo prossimale, ma con tubulo quasi retto presso il bulbo prossimale. Lungh. 1,9 mm. Borneo .... *E. eleganticollis* sp. n.

ETIMOLOGIA. Dato che la nuova specie mostra un pronoto fortemente ristretto e allungato, cioè elegante, prende il nome di *Eusteniamorpha* "Dal collo (cioè pronoto) elegante".

Eusteniamorpha kinabaluensis sp. n. Figg. 66-69

Holotypus ♀, Sabah, Kinabalu N. P., 29.X.1990, leg. G. de Rougemont (MRSNT).

Paratypi: 1 ♀, stessa provenienza; 9 es., Borneo-Sabah, Crocker Ra., 1350 m, Km 60, rte. Kota Kinabalu-Tambunan, 17.V.1987, leg. Burckhardt & Löbl; 1 es., Borneo-Sabah,



FIGG. 56-65

Edeago in visione laterale e ventrale, habitus e spermateca. 56-61: *Eusteniamorpha variabilis* sp. n.; 62-65: *Eusteniamorpha eleganticollis* sp. n.

Crocker Ra., 1550-1650 m, 16.V.1987, leg. Burckhardt & Löbl; 3 ♀♀, Sabah, Poring Hot Springs, 500 m, 6-8.V.1987, leg. Burckhardt & Löbl; 3 es., Sabah, Poring Hot Springs, 600 m, Bat Cave, 10.V.1987, leg. Burckhardt & Löbl; 10 es., Borneo-Sabah, E Mt. Kinabalu, 1150 m, rte. Ranau-Kota Kinabalu, 24.V.1987, leg. Burckhardt & Löbl.

DESCRIZIONE. Lungh. 1,7 mm. Corpo lucido e bruno, con addome bruno-rossiccio avente gli uriti liberi terzo e quarto bruni; antenne bruno-rossicce; zampe gialle. La punteggiatura del capo e del pronoto è netta e profonda, ma superficiale sul disco del capo e assente ai lati del pronoto, che mostra un solco mediano profondo, diviso in due rami all'indietro. La punteggiatura delle elitre è superficiale. La granulosità dell'addome è svanita. Edeago figg. 67-68, spermateca fig. 69.

COMPARAZIONI. La nuova specie, per i caratteri del pronoto, cioè per la presenza su esso di ampie aree senza punti e lucide, per i solchi basali degli uroterghi basali punteggiati, per la carena mediana dei tre uroterghi basali e per la forma dell'edeago, è simile a *E. borneensis* Cameron, 1933. Se ne distingue per i caratteri dati nella seguente chiave.

1 Undicesimo antennomero rossiccio, con metà apicale gialla; quarto antennomero più lungo che largo; solco mediano del pronoto interrotto alla metà posteriore; punteggiatura del pronoto finissima sulla parte anteriore; presenza di un solco largamente arcuato basale del pronoto; armatura interna dell'edeago sottile e più lunga. Lungh. 2,5 mm .... *E. borneensis* Cameron

- Undicesimo antennomero interamente bruno-rossiccio; quarto antennomero lungo quanto largo; solco mediano del pronoto esteso fino quasi al margine posteriore, dove è diviso in due rami corti; punteggiatura del pronoto grossolana anche sulla parte anteriore; assenza di un solco largamente arcuato basale del pronoto; armatura interna dell'edeago larga e corta. Lungh. 1,7 mm .... *E. kinabaluensis* sp. n.

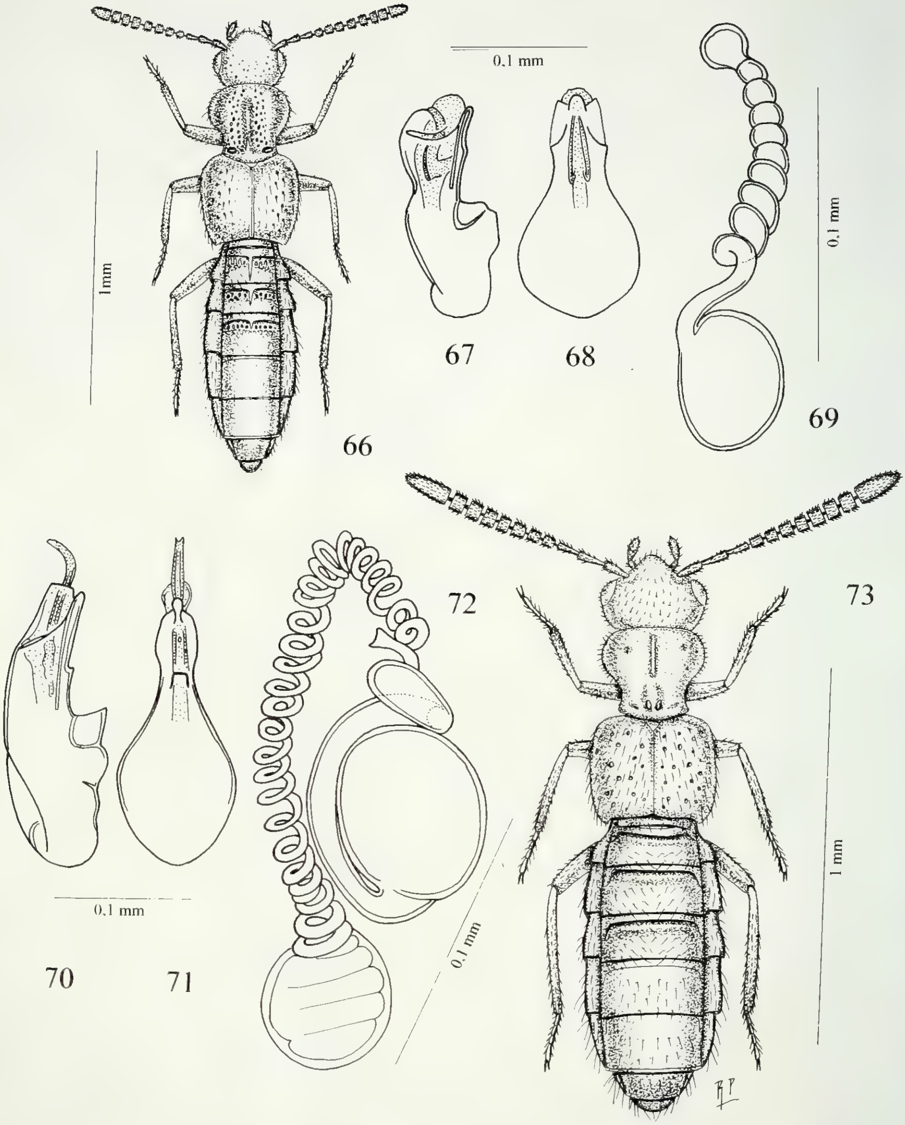
ETIMOLOGIA. Ovviamente, la nuova specie prende nome dal M. Kinabalu.

Eusteniamorpha muluicola sp. n. Figg. 70-73

Holotypus ♂, Sarawak-Borneo, Mulu Nat. Park, leg. H. Franz (CFR).
Paratypus: 1 ♀, stessa provenienza.

DESCRIZIONE. Lungh. 1,4 mm. Corpo lucido e giallo-rossiccio, con elitre brune, tranne la base rossiccia; antenne rossicce; zampe gialle. La punteggiatura del capo è fine e distinta, quella delle elitre è forte, netta e rada. La granulosità del pronoto è superficiale, quella dell'addome è assai svanita. Il solco mediano del pronoto è interrotto a metà, sulla parte posteriore si trova una depressione mediana con due forti punti posteriori. Edeago figg. 70-71, spermateca fig. 72.

COMPARAZIONI. Specie del genere *Eusteniamorpha* che presentano una spermateca con spire libere numerosissime, come quelle della spermateca della nuova specie, non sono state finora osservate. La specie, che, per i caratteri esterni e della spermateca, più si avvicina è *E. aspera* (Fauvel, 1905), di Giava. Ma questa ha le spire della spermateca fuse tra loro e il pronoto è coperto di punteggiatura profonda e non di granulosità superficiale e fine come sul pronoto della nuova specie.



FIGG. 66-73
Habitus, edeago in visione laterale e ventrale e spermateca. 66-69: *Eusteniamorpha kinabaluensis* sp. n.; 70-73: *Eusteniamorpha muluicola* sp. n.

ETIMOLOGIA. La nuova specie prende nome dalla località tipica: Mulu Nat. Park.

CHIAVE DELLE SPECIE DEL BORNEO DEL GENERE *EUSTENIAMORPHA* CAMERON

1	Elitre più strette del pronoto.	*E. strictipennis* sp. n.
-	Elitre larghe quanto il pronoto o più larghe.	2
2	Elitre larghe quanto il pronoto.	*E. introflexa* sp. n.
-	Elitre più larghe del pronoto.	3
3	Elitre, misurate dall'omero all'angolo posteriore esterno, più corte del pronoto o lunghe quanto il pronoto.	4
-	Elitre, misurate dall'omero all'angolo posteriore esterno, più lunghe del pronoto.	13
4	Elitre, misurate dall'omero all'angolo posteriore esterno, lunghe quanto il pronoto.	5
-	Elitre, misurate dall'omero all'angolo posteriore esterno, più corte del pronoto.	6
5	Pronoto lungo quanto largo; elitre coperte di robusta punteggiatura sparsa.	*E. subtiliapex* sp. n.
-	Pronoto più largo che lungo; elitre coperte di granuli allungati salienti.	*E. vitreipes* sp. n.
6	Pronoto più lungo che largo.	*E. eleganticollis* sp. n.
-	Pronoto lungo quanto largo o più largo che lungo.	7
7	Pronoto lungo quanto largo.	8
-	Pronoto più largo che lungo.	9
8	Quarto antennomero trasverso; angoli posteriori del pronoto più sporgenti; elitre irregolarmente punteggiate; introflessione apicale del bulbo distale della spermateca, presente.	*E. triangulum* sp. n.
-	Quarto antennomero più lungo che largo; angoli posteriori del pronoto meno sporgenti; elitre coperte di granuli salienti; introflessione apicale del bulbo distale della spermateca, assente.	*E. incongruens* sp. n.
9	Pronoto fortemente sinuato davanti agli angoli posteriori.	10
-	Pronoto non o appena sinuato davanti agli angoli posteriori.	12
10	Quarto antennomero trasverso; elitre con punteggiatura poco distinta.	*E. bulbosa* sp. n.
-	Quarto antennomero più lungo che largo; elitre nettamente punteggiate. . . .	11
11	Undicesimo antennomero giallo all'apice; pronoto poco più largo del capo, senza profonda fossetta mediana posteriore; elitre poco ristrette all'indietro.	*E. magnatheca* sp. n.
-	Undicesimo antennomero uniformemente rossiccio; pronoto molto più largo del capo, con profonda fossetta mediana posteriore; elitre fortemente ristrette all'indietro.	*E. deiectorum* sp. n.
12	Undicesimo antennomero giallo; quarto antennomero trasverso; occhi più ridotti; solco mediano del pronoto poco profondo e non allargato posteriormente.	*E. burckhardti* sp. n.
-	Undicesimo antennomero giallo-rossiccio; quarto antennomero più lungo che largo; occhi meno ridotti; solco mediano del pronoto profondo e allargato posteriormente.	*E. sabahensis* sp. n.

13 Pronoto lungo quanto largo; parte posteriore del pronoto senza profondo solco o depressione o fossetta. . . . . *E. borneensis* Cameron

- Pronoto più lungo che largo; parte posteriore del pronoto con profondo solco o con depressione o con fossetta. 14

14 Capo punteggiato o a granulosità poco distinta. 15

- Capo a granulosità forte. 17

15 Quarto antennomero lungo quanto largo; solco mediano del pronoto profondo, posteriormente diviso in due rami; fondo dei solchi basali dei tre uroterghi liberi basali, punteggiato. . . . . *E. kinabaluensis* sp. n.

- Quarto antennomero più lungo che largo; solco mediano del pronoto interrotto sulla metà posteriore; fondo dei solchi basali dei tre uroterghi liberi basali, non punteggiato. 16

16 Angoli posteriori del pronoto fortemente sporgenti; pronoto coperto di granulosità superficiale; elitre con punteggiatura netta, rada e forte. . . . . *E. muluicola* sp. n.

- Angoli posteriori del pronoto non sporgenti; pronoto con punteggiatura netta solo a ciascun lato del solco mediano; elitre coperte di granulosità superficiale, senza punteggiatura forte. . . . . *E. polita* sp. n.

17 Elitre coperte di granulosità assai saliente. . . . . *E. geniculata* sp. n.

- Elitre coperte di netta punteggiatura, irregolarmente distribuita. 18

18 Undicesimo antennomero interamente giallo-rossiccio; quarto antennomero trasverso; pronoto quasi trapezoidale. . . . . *E. monoglobus* sp. n.

- Undicesimo antennomero giallo con base giallo-rossiccia; quarto antennomero più lungo che largo; pronoto non trapezoidale. 19

19 Granulosità del capo estesa anche sulla fronte; elitre poco più lunghe del pronoto e fortemente ristrette all'indietro. . . . . *E. anteopacissima* sp. n.

20 Granulosità del capo assente sulla fronte e sul disco per un'area triangolare; elitre molto più lunghe del pronoto e non ristrette all'indietro. . . . . *E. variabilis* sp. n.

KEY OF THE SPECIES FROM BORNEO OF THE GENUS *EUSTENIAMORPHA* CAMERON

1 Elytra narrower than the pronotum. . . . . *E. strictipennis* sp. n.

- Elytra as wide as the pronotum or wider. 2

2 Elytra as wide as the pronotum. . . . . *E. introflexa* sp. n.

- Elytra wider than the pronotum. 3

3 Elytra, measured by the humerus to the external rear angle, shorter than the pronotum or as long as the pronotum. 4

- Elytra, measured by the humerus to the external rear angle, longer than the pronotum. 13

4 Elytra, measured by the humerus to the external rear angle, as long as the pronotum. 5

- Elytra, measured by the humerus to the external rear angle, shorter than the pronotum. 6

5 Pronotum as wide as long; elytra covered with strong scattered punctuation. . . . . *E. subtiliapex* sp. n.

- Pronotum wider than long; elytra covered with granules elongate projecting. . . . . *E. vitreipes* sp. n.

6 Pronotum longer than wide. . . . . *E. eleganticollis* sp. n.

- Pronotum as wide as long or wider than long. 7

7 Pronotum as wide as long. 8

- Pronotum wider than long. 9

8 Fourth antennomere transverse; projecting rear angles of the pronotum; elytra irregularly punctored; apical introflexion of the distal bulb of the spermatheca, present. . . . . *E. triangulum* sp. n.

- Fourth antennomere longer than wide; rear angles of pronotum not projecting; elytra covered with salient granules; apical introflexion of the distal bulb of the spermatheca absent. . . . . *E. incongruens* sp. n.

9 Pronotum strongly widening in front of the rear angles. 10

- Pronotum not or scarcely widening in front of the rear angles. 12

10 Fourth antennomere transverse; elytra with few punctures. . *E. bulbosa* sp. n.

- Fourth antennomere longer than wide; clearly punctured elytra. 11

11 Eleventh antennomere entirely yellow; pronotum a little broader than the head, without deep median posterior fovea; elytra slightly narrowed posteriorly. . . . . *E. magnatheca* sp. n.

- Eleventh antennomere uniformly reddish; pronotum much broader than the head, with deep posterior medianfovea; elytra strongly narrowed posteriorly. . . . . *E. deiectorum* sp. n.

12 Eleventh antennomere yellow; fourth antennomere transverse; eyes more reduced; median furrow of the pronotum not very deep and not widened posteriorly. . . . . *E. burckhardti* sp. n.

- Eleventh antennomere yellowish-red; fourth antennomere longer than wide; eyes less reduced; median furrow of the pronotum deep and widened posteriorly. . . . . *E. sabahensis* sp. n.

13 Pronotum as wide as long; basally pronotum without deep furrow, depression or fovea. . . . . *E. borneensis* Cameron

- Pronotum wider than long; basally pronotum with deep furrow, depression or fovea. 14

14 Head punctured or covered with a few granules. 15

- Head strongly granulate. 17

15 Fourth antennomere as wide as long; median furrow of the pronotum deep, posteriorly divided in two branches; bottom of the basal furrows of the three basal free urotergites punctuated. . . . . *E. kinabaluensis* sp. n.

- Fourth antennomere longer than wide; median furrow of the pronotum interrupted in the basal half; bottom of the basal furrows of the three basal free urotergites not punctuated. 16

16 Rear angles of the pronotum strongly projecting; pronotum covered with superficial granularity; elytra with clear punctuation, strong and sparse. . . . . *E. muluicola* sp. n.

- Rear angles of the pronotum not proiecting; pronotum with clean puncturation only on each side of the median furrow; elytra covered with superficial granularity, without strong punctures. . . . . *E. polita* sp. n.

17 Elytra granulate. . . . . *E. geniculata* sp. n.

- Elytra covered with clear punctuation, irregularly distributed. 18

18 Eleventh antennomere entirely yellowish-red; fourth antennomere transverse; pronotum almost trapezoidal. . . . . *E. monoglobus* sp. n.

- Eleventh antennomere yellow with yellowish-red base; fourth antennomere longer than wide; pronotum not trapezoidal. 19

19 Granularity of the head also extended on the forehead; elytra a little longer than the pronotum and strongly narrowed behind. . . . . *E. anteopacissima* sp. n.

20 Granularity of the head absent on the forehead in a triangular area; elytra longer than the pronotum and not narrowed behind. . . *E. variabilis* sp. n.

DISCUSSIONE

La chiave delle specie borneensi del genere *Eusteniamorpha,* non le presenta ordinate in base alle affinità tassonomiche, in quanto di tutte le specie non è nota la spermateca. Infatti sono i caratteri di quest'organo, più che quelli dell'edeago, che permettono di affrontare il tentativo di riunire in gruppi di affinità le specie del genere. Risulta evidente che due sono i gruppi di appartenenza delle specie del Borneo e delle isole e territori geograficamente più o meno vicini. Il primo, caratterizzato da una parte della spermateca foggiata a spire fa capo a *E. aspera* (Fauvel). Il secondo, caratterizzato da spermateca senza spire fa capo a *E. opacicollis* (Fauvel). Viene qui dato l'elenco delle specie, di cui è nota la spermateca, raggruppate secondo il gruppo di appartenenza.

Gruppo di *E. aspera*

aspera (Fauvel, 1905).	Giava
boettcheri Bernhauer, 1928. . .	Filippine
chinensis Pace, 1998.	Cina
eleganticollis sp. n.	Borneo
kinabaluensis sp. n.	Borneo
muluicola sp. n.	Borneo
philippina Bernhauer, 1920.	Filippine

Gruppo di *E. opacicollis*

baliensis Pace, 1986. . . .	Bali
bulbosa sp. n.	Borneo
burckhardti sp. n.	Borneo
celata Pace, 1993.	Singapore
deharvengi Pace, 1990. .	Filippine
deiectorum sp. n.	Borneo
geniculata sp. n.	Borneo
incongruens sp. n.	Borneo
introflexa sp. n.	Borneo
javanensis Pace, 1993. . .	Giava
livida Bernhauer, 1928.	Filippine
magnatheca sp. n.	Borneo
monoglobus sp. n.	Borneo
monstrosicollis Bernhauer, 1928.	Filippine
nepalensis Pace, 1989.	Nepal
opacicollis Fauvel, 1905.	Birmania
orousseti Pace, 1990.	Filippine
polita sp. n.	Borneo
punctipennis Bernhauer, 1928. . .	Filippine
rougemonti Pace, 1992.	Thailandia

rufa Cameron, 1933.	Singapore
ruiliensis Pace, 1998.	Cina
sabahensis sp. n.	Borneo
smetanai Pace, 1989.	Nepal
strictipennis sp. n.	Borneo
thailandensis Pace, 1992. . .	Thailandia
toragia Pace, 1986.	Celebes
triangulum sp. n.	Borneo
variabilis sp. n.	Borneo
vitreipes sp. n.	Borneo
zhejiangensis Pace, 1998. . .	Cina

Il primo gruppo, quello di *E. aspera,* contando un numero nettamente minore di specie, potrebbe essere cronologicamente più antico e in fase di estinzione, soppiantato da una successiva sovrapposizione delle specie del secondo gruppo, quello di *E. opacicollis,* che, contando un numero maggiore di specie, potrebbe essere cronologicamente di più recente diffusione e più adattabile alle condizioni dell'habitat odierno.

Autalia kinabaluensis sp. n. Figg. 74-77

Holotypus ♂, Borneo-Sabah, Mt. Kinabalu Nat. Pk., HQ Silau Silau tr., 1565 m, 3.VIII.1988, leg. A. Smetana, (MHNG).

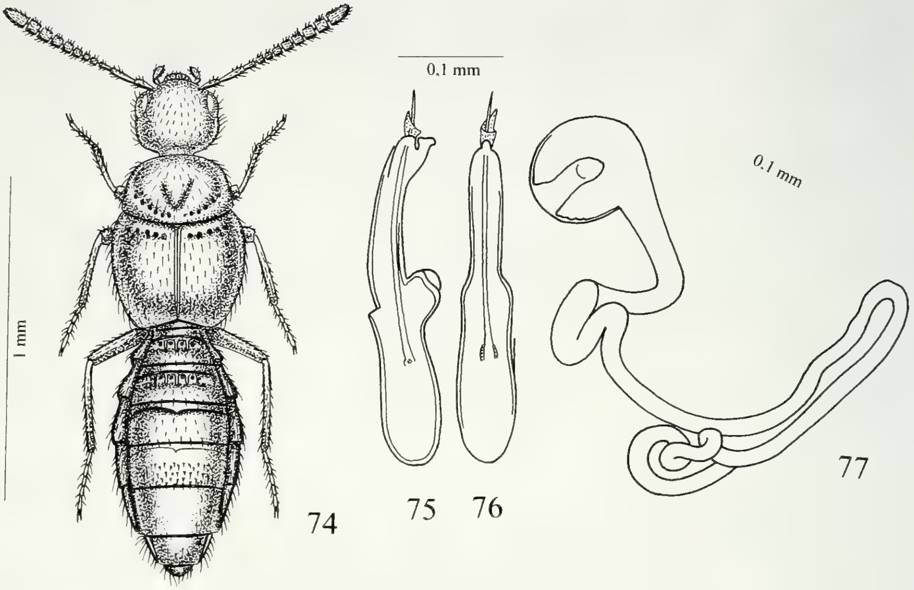
Paratypi: 1 ♀, Borneo-Sabah, Mt. Kinabalu Nat. Pk., HQ Liwagu Rv., 1500 m, 30.IV.1987, leg. A. Smetana; 9 es., Borneo-Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 920 m, 9.V.1987, leg. A. Smetana; 6 es., Borneo-Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 495 m, 30-31.VIII.1988, leg. A. Smetana; 46 es., Borneo-Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 550-600 m, Bat Cave, 10-11.V.1987, leg. Burckhardt & Löbl; 35 es., Borneo-Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 500 m, 7.V.1987, leg. Burckhardt & Löbl; 3 es, Borneo-Sabah, Mt. Kinabalu Nat. Pk., Poring Hot Springs, 500 m, 11.V.1987, leg. Burckhardt & Löbl.

Descrizione. Lungh. 1,6 mm. Corpo lucido e rossiccio, con elitre brune; antenne rossicce con i due antennomeri basali giallo-rossicci; zampe gialle. La punteggiatura sul corpo è indistinta, tranne forti punti sulla parte posteriore del pronoto e alla base delle elitre. Solo il quarto urotergo libero presenta granulosità evidente e pubescenza fitta. Non è visibile reticolazione sul corpo. Edeago figg. 75-76, spermateca fig. 77.

Comparazioni. Finora specie del genere *Autalia* Leach, 1819, nel Borneo non erano note. La nuova specie è comparabile con la geograficamente vicina *A. minuta* Cameron, 1936, di Sumatra. Se ne distingue per i caratteri dati nella seguente chiave.

1 Corpo piceo, con capo nero; antenne nere, con i tre antennomeri basali giallo-bruni; capo più largo del pronoto che è circa lungo quanto largo, solcato sulla linea mediana; una fovea basale a ciascun lato del solco mediano; due impressioni basali su ciascuna elitra. Lungh. 1,0 mm. Sumatra. . . . . *A. minuta* Cameron

2 Corpo rossiccio, con elitre brune; antenne rossicce, con i due antennomeri basali giallo-rossicci; capo più stretto del pronoto che è molto più largo che lungo, non solcato sulla linea mediana; una fila arcuata di punti sta presso la base del pronoto; una fila di robusti punti basali si trova su ciascuna elitra. Lungh. 1,6 mm. Borneo. . . . . . *A. kinabaluensis* sp. n.



FIGG. 74-77
Habitus, edeago in visione laterale e ventrale e spermateca. 74-77: *Autalia kinabaluensis* sp. n.

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BIBLIOGRAFIA

BERNHAUER, M. 1928. Die Staphyliniden der Philippinen. *Verhandlungen der zoologisch-botanischen Gesellschaft in Wien* 78: 29-44.

BLACKWELDER, R.E. 1952. The generic Names of the Beetle Family Staphylinidae, with an essay on genotypus. *Smithsonian Institution, United States National Museum, Bulletin* 200: 483 pp.

CAMERON, M. 1920. New species of Staphylinidae from Singapore, Part III. *Transaction of the Entomological Society of London* 1920: 212-284.

CAMERON, M. 1933. Staphylinidae (Col.) from Mount Kinabalu. *Journal of the Federated Malay States Museums* 17: 338-360.

CAMERON, M. 1936. Fauna Sumatrensis. Bijdrage N° 77. Staphylinidae (Col.). *Tijdschrift voor Entomologie* 79: 1-24.

FAUVEL, A. 1905. Staphylinides exotiques nouveaux, pt. 3. *Revue d'Entomologie* 24: 113-147.

LEACH, W.E. 1819. New genera. *In*: Samuelle. The Entomologist's useful Compendium: 496 pp., London.

PACE, R. 1984. Aleocharinae del Madagascar raccolte da Yves Gomy (Coleoptera, Staphylinidae). *Revue suisse de Zoologie* 91: 521-543.

PACE, R. 1986. Aleocharinae dell'Asia sudorientale raccolte da G. de Rougemont (Coleoptera, Staphylinidae). *Bollettino del Museo civico di Storia naturale di Verona* 23: 139-237.

PACE, R. 1989. Aleocharinae nepalesi del Museo di Ginevra. Parte I (Coleoptera, Staphylinidae). *Revue suisse de Zoologie* 96: 483-539.

PACE, R. 1990. Aleocharinae delle Filippine (82° Contributo alla conoscenza delle Aleocharinae) (Coleoptera, Staphylinidae). *Mémoires du Muséum national d'Histoire naturelle* (A) 147: 57-113.

PACE, R. 1992. Aleocharinae della Thailandia (Coleoptera. Staphylinidae). *Bollettino del Museo civico di Storia naturale di Verona* 17: 227-268.

PACE, R. 1993. Nuove Aleocharinae Orientali (Coleoptera, Staphylinidae). *Bollettino del Museo civico di Storia naturale di Verona* 16: 127-180.

PACE, R. 1998. Aleocharinae della Cina. Parte I (Coleoptera, Staphylinidae). *Revue suisse de Zoologie* 105: 139-220.

PACE, R. 1999. Insectes Coléoptères Staphylinidae Aleocharinae. *Faune de Madagascar* 89: 261 pp.

THOMSON, C.G., 1859. Skandinaviens Coleoptera, synoptiskt bearbetade, vol. 1. *Berlingska Boktryckeriet, Lund,* 290 pp.

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Three new Malagasy species of *Xyrodromeus* (Ephemeroptera: Baetidae) with the first generic description of the adults

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Three new Malagasy species of *Xyrodromeus* (Ephemeroptera: Baetidae) with the first generic description of the adults. - The genus *Xyrodromeus* Lugo-Ortiz & McCafferty includes Afrotropical species of Baetidae (Ephemeroptera) with bladelike mandibles. Three new species of *Xyrodromeus*, *X. modestus*, *X. latipalpus* and *X. sartorii*, are described from the larval stage and the male imago of *Xyrodromeus namarona* Lugo-Ortiz & McCafferty is described from reared material. The knowledge of the imaginal stage greatly clarifies the systematic position of the genus *Xyrodromeus*. A key to larvae of the Malagasy species of *Xyrodromeus* is included.

Key-words: Ephemeroptera - Baetidae - *Xyrodromeus* - new species - Madagascar.

INTRODUCTION

The genus *Xyrodromeus* Lugo-Ortiz & McCafferty was established for two species presenting highly modified mandibles with bladelike incisors (Lugo-Ortiz & McCafferty, 1997). The type-species *X. africanus* Lugo-Ortiz & McCafferty was described from Kenya (East Africa) and *X. namarona* Lugo-Ortiz & McCafferty from Madagascar. The mouthparts of *Xyrodromeus* are highly specialized for scraping stones. Similar adaptations can be found in different baetid lineages in Madagascar, such as *Rheoptilum* Gattolliat (Gattolliat, 2001a), *Dabulamanzia* Lugo-Ortiz & McCafferty (Gattolliat & Sartori, 2000) and *Cloeodes* Traver (Gattolliat, 2001b). Based only on the larval stage, the interpretation of the phylogenetic position of *Xyrodromeus* was unclear, and Lugo-Ortiz & McCafferty (1997) suggested different hypothetical relationships. Based on the absence of a villopore and the structure of the mandible, they concluded that *Xyrodromeus* did not belong to the *Baetis* complex as defined by Waltz & McCafferty (1987c). The *Cloeodes* complex was also eliminated because of the absence of a subproximal arc of setae on the tibiae (Waltz & McCafferty, 1987a, b; Lugo-Ortiz & McCafferty, 1998b; Gattolliat, 2001b). Lugo-Ortiz & McCafferty (1997) indicated a possible relationship with the *Bugilliesia* complex of Africa defined by Lugo-Ortiz & McCafferty (1996) or with Oriental or

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Australian taxa, and also noted the similarity of the labrum of *Xyrodromeus* and *Dicentroptilum* Wuillot & Gillies.

I describe herein three new species from Madagascar and also the male imago of *Xyrodromeus namarona*. The knowledge of the imaginal stage of *Xyrodromeus* provides additional characters that clarify the systematic position of this genus.

The holotypes and part of the paratypes are housed in the Museum of Zoology, Lausanne, Switzerland. Other paratypes are deposited in the Museum National d'Histoire Naturelle, Paris.

TAXONOMY

Xyrodromeus modestus sp. n. Figs 1-13

MATERIAL

Holotype: 1 larva (P0893), Madagascar, Ampary bas., Anlanbe riv., Loc. Anjanaharibe Sud-Ouest Camp1, Long. 49°26'53" E, Lat. 14°47'00" S, Alt. 1200 m, 26.10.1999. Doumenq E.

Paratypes: 1 female larva 893a (on slide), 1 male larva 893b (on slide) and 10 larvae (P0893), same data as holotype. 14 larvae (P0897), same locality as holotype, 27.10.1999. Doumenq E. 1 larva, P1009, Madagascar, Lokoho bas., Manantenina riv., Loc. Marojejy Camp2, Long. 49°45'58" E, Lat. 14°26'23" S, Alt. 800 m, 26.11.1999. Doumenq E. 14 larvae (P1021), Madagascar, Lokoho bas., Marolakana riv., Loc. Anjanaharibe-Sud Camp 3, Long. 49°26'50" E, Lat. 14°44'50" S, Alt. 1550 m, 08.12.1999. Doumenq E.

LARVA

Maximum length: Body 5.7 mm. Cerci 6.3 mm and terminal filament 2.8 mm.

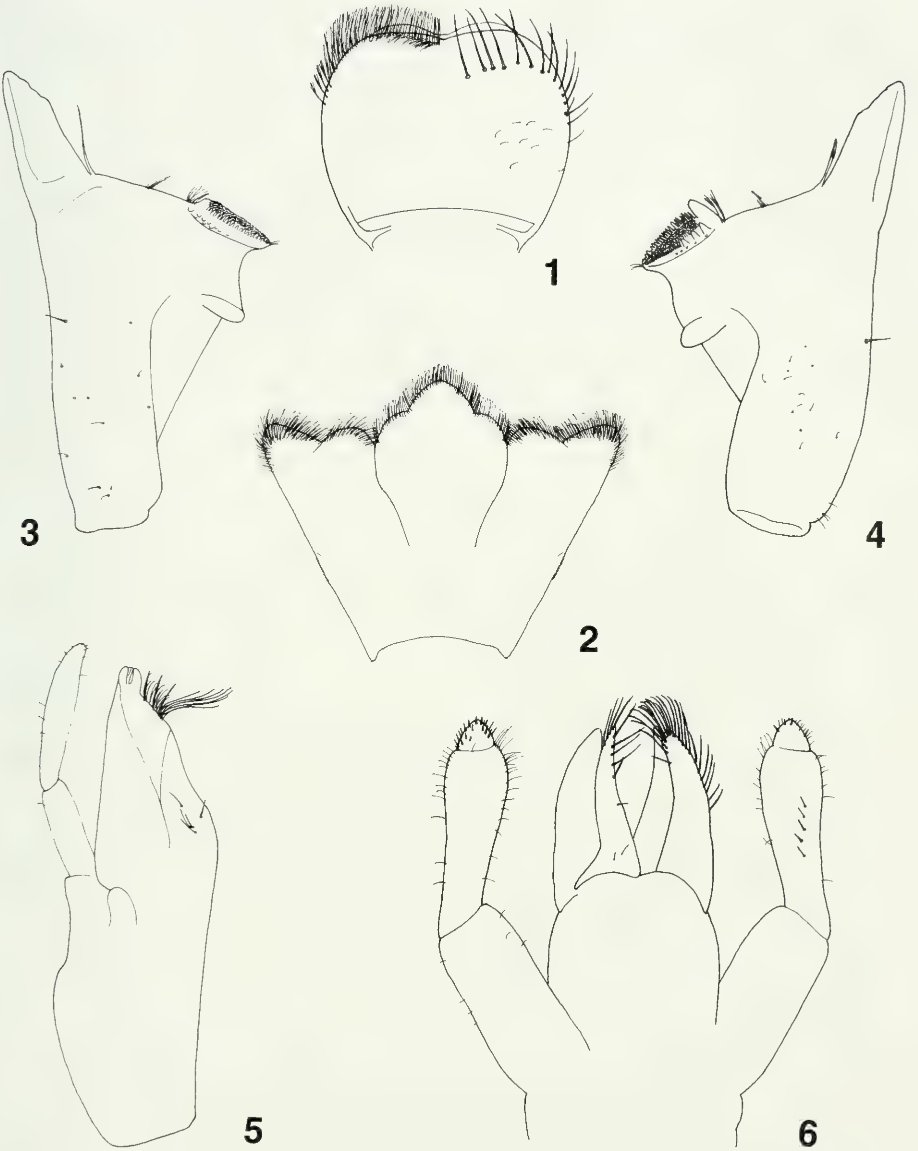
Head. Coloration almost uniformly light brown with vermiform marks on vertex and frons. Antennae light brown. Turbinate eyes light brown. Labrum (Fig. 1) narrow, rounded with a narrow anteromedial emargination; distal margin with two rows of setae, setae of the longer row feathered; dorsal surface with an arc of about 10 long setae and a submedial pair of setae on each side, few short setae in the proximal half. Hypopharynx as in figure 2, lingua trilobate with minute thin setae.

Right mandible (Fig. 3) with completely fused incisors; prostheca reduced to a simple filament; setae between prostheca and mola reduced to a tuft; tuft of small setae near the mola; tuft of setae at the apex of the mola reduced to 2 or 3 setae; basal half with a stout seta perpendicular to the margin and few smaller setae dorsally.

Left mandible (Fig. 4) with completely fused incisors; prostheca reduced to a bifid filament; setae between prostheca and mola reduced to a tuft; tuft of feathered setae near the mola well-developed; tuft of setae at the apex of the mola reduced to 2 or 3 setae; basal half with a stout seta perpendicular to the margin and few setae dorsally.

Maxillae (Fig. 5) with the distal tooth opposed to the 3 others; 2 rows of setae, the first one formed by abundant small setae and the second by 3 long stout setae ending with 6 to 7 setae twice as long as the others, without pectinate or spine-like setae in the middle of the range; 4 setae at the base of the galea roughly arranged in a row; 1 single small seta perpendicular to the margin of the galea.

Labium (Fig. 6) with glossae and paraglossae equal in length; apical half of the inner margin of glossae with stout setae, very few small setae on the basal half of the ventral side, first segment of the labial palp 0.8 x length of second and third

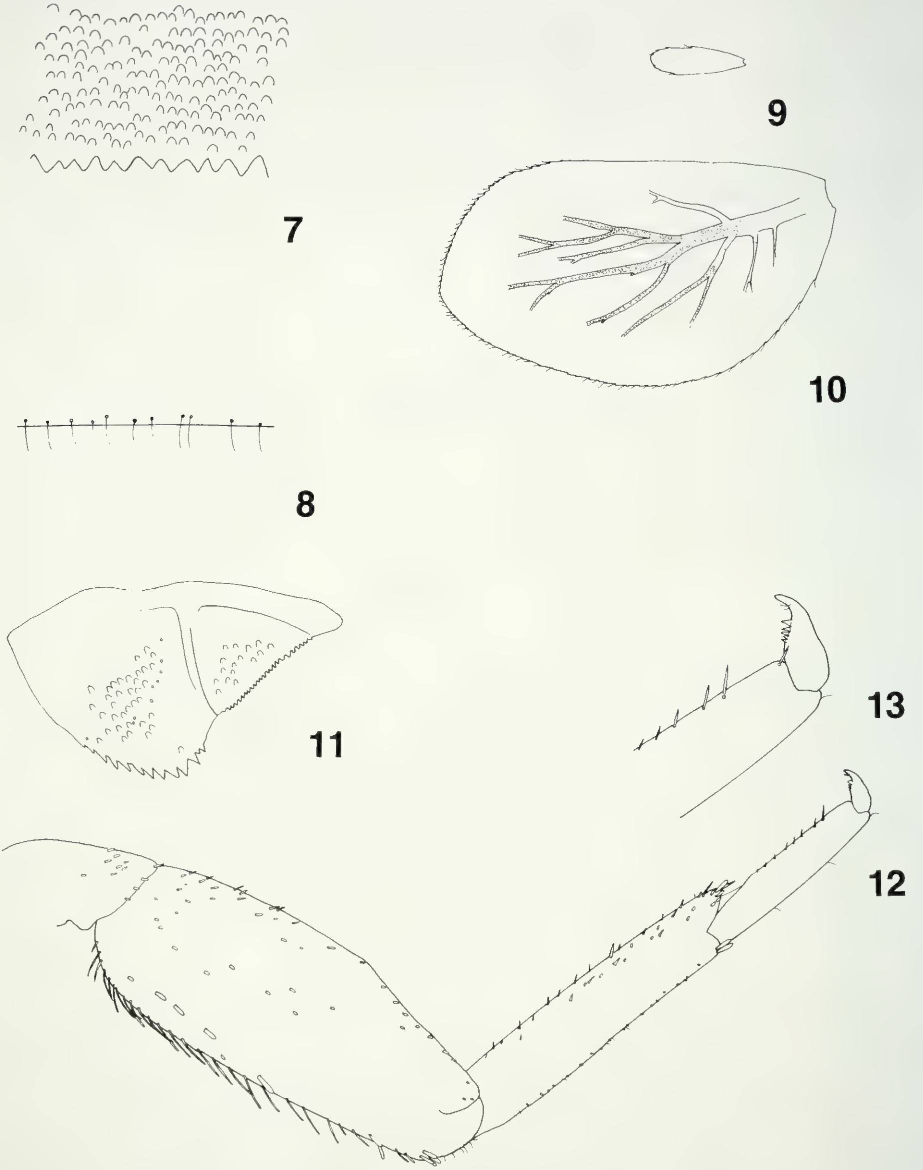


FIGS 1-6

Larval structures of *Xyrodromeus modestus*: 1: labrum (left: ventral; right: dorsal) 2: hypopharynx. 3: right mandible. 4: left mandible. 5: right maxilla. 6: labium.

combined; second segment weakly enlarged apically, row of 4 small setae; third segment slightly more narrow than apex of the second, with stout pointed setae apically.

Thorax. Coloration light brown. Hindwing pads present. Legs light brown, except the apex of femora and tarsi darker. Forelegs (Fig. 12). Coxae with small stout



FIGS 7-13

Larval structures of *Xyrodromeus modestus*: 7: posterior margin of the fourth tergum. 8: posterior margin of the fourth sternum. 9: first gill. 10: fourth gill. 11: paraproct. 12: foreleg. 13: tarsal claw.

setae. Femora dorsally with a row of long setae; submarginal row of 6 blunt setae; dorso-apical patch of 4 spatulate setae; short, pointed setae on the ventral margin. Tibiae dorsally with minute blunt setae, apex with two long setae; ventral margin with small pointed setae; tibio-patellar suture absent. Tarsi with few dorsal setae; tarsal claws (Fig. 13) with a single row of 5 teeth increasing in length, subapical pair of setae present. Second and third legs similar to foreleg, except tibio-patellar suture present.

Abdomen. Uniformly light brown, except terga 5 to 8 with a brown slender, posterior U-shaped pattern. Terga (Fig. 7) with scales bases and without setae; posterior margin with broad, blunt spination. Sterna (Fig. 8) 1-6 pale yellow, without scale bases; smooth posterior margin without spines and with thin setae along the margin; sterna 7-9 brown, with pointed spines. Asymmetrical gills on abdominal segments 1 to 7; gill 1 (Fig. 9) oval, greatly reduced, without tracheation; gills 2-7 (Fig. 10) with dark tracheation, serrated with thin setae apically and posteriorly. Paraproct (Fig. 11) with about 12 pointed marginal spines; surface with about 35 scale bases; posterolateral extension with about 15 scale bases and with about 25 small spines along the margin.

ADULTS: unknown.

ETYMOLOGY

The specific epithet is Latin expressing the low degree of development of the mouthparts, especially of the labial palp and the labrum.

Xyrodromeus latipalpus sp. n. Figs 14-26

MATERIAL

Holotype: 1 larva (P1008), Madagascar, Lokoho bas., Manantenina riv., Loc. Marojejy Camp1, Long. 49°46'48" E, Lat. 14°24'43" S, Alt. 425 m, 25.11.1999. Doumenq E.

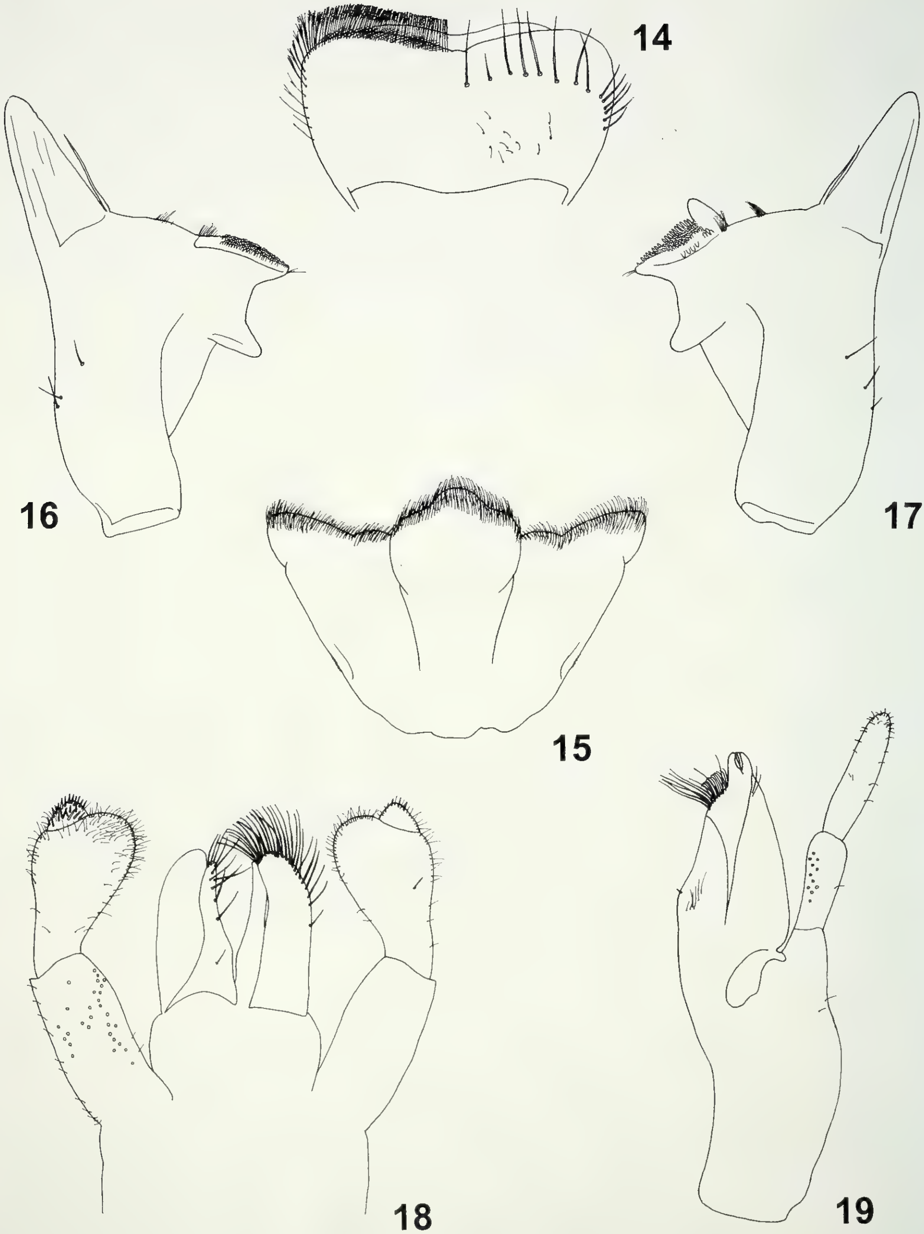
Paratypes: 1 female larva 1008a (on slide), 1 male larva 1008b (on slide) and 17 larvae (P1008), same data as holotype. 1 female larva 458a (on slide) and 2 larvae (P0458), Madagascar, Bas. Matitanana, Riv. Maintimbahatra, Loc. Village Faliarivo, Long. 47°19'28" E, Lat. 22°06'10" S, altitude 500 m, 21.6.1995. Andriamihaja M.R. and Ralaiteferana A. 3 larvae (P0874), Madagascar, Betaolana bas., Ambolokopatrika riv., Loc. Betaolana Camp 1, Long. 49°26'47" E, Lat. 14°32'25" S, Alt. 800 m, 09.10.1999. Doumenq E. 1 larva (P1023), Madagascar, Lokoho bas., Marolakana riv., Loc. Anjanaharibe-Sud Camp 1, Long. 49°30'84" E, Lat. 14°45'43" S, Alt. 800 m, 10.12.1999. Doumenq E.

LARVA

Maximum length: Body 5.1 mm. Cerci 3.2 mm and terminal filament 2.3 mm.

Head. Coloration almost uniformly light brown. Antennae pale yellow, except scape and pedicel light brown. Turbinate eyes light brown. Labrum (Fig. 14) trapezoid, broader apically; distal margin with two rows of setae, setae of the longer row feathered; dorsal surface with an arc of about 6+6 long setae on each side, submedial pair of setae, few short setae in the proximal half; each ventral, lateral surface with row of 3 minute setae. Hypopharynx as in figure 15, lingua trilobate with minute thin setae.

Right mandible (Fig. 16) with completely fused incisors; prostheca reduced to a simple filament; setae between prostheca and mola reduced to a tuft; tuft of small setae near the mola; tuft of setae at the apex of the mola reduced to 2 or 3 setae; basal half with 3 long and stout setae dorsally.



FIGS 14-19

Larval structures of *Xyrodromeus latipalpus*: 14: labrum (left: ventral; right: dorsal) 15: hypopharynx. 16: right mandible. 17: left mandible. 18: labium. 19: left maxilla.

Left mandible (Fig. 17) with completely fused incisors; prostheca reduced to a simple filament, without apical teeth; setae between prostheca and mola reduced to a tuft; tuft of feathered setae near the mola well-developed; tuft of setae at the apex of the mola reduced to 2 or 3 setae; basal half with 3 long and stout setae dorsally.

Maxillae (Fig. 19) with distal tooth opposed to the 3 others; 2 rows of setae, the first one formed by abundant small setae and the second by 2 long stout setae ending with 6 to 7 setae at least twice as long as the others, without pectinate or spine-like setae in the middle of the range; 6 setae at the base of the galea roughly arranged in a row; 1 single small seta perpendicular to the margin of the galea.

Labium (Fig. 18) with glossae and paraglossae subequal in length; apical half of the inner margin of glossae with long, stout setae; a single seta on the basal half of the ventral side; first segment of the labial palp 1.1 x length of the second and third combined; second segment with broadly rounded distomedial expansion, covered with numerous thin setae, ventral row reduced to a single seta; third segment asymmetrical, apically with stout pointed setae and thin ones.

Thorax. Coloration light brown. Hindwing pads present. Legs yellow except the apex and ventral margin of femora darker. Forelegs (Fig. 25). Coxae with minute stout setae. Femora dorsally with a row of numerous setae; submarginal row of setae absent; dorso-apical patch of 4 spatulated setae; minute, blunt or pointed setae on the ventral margin. Tibiae dorsally with a row of minute blunt setae and some thin short setae, apex with a single long seta; ventral margin with small pointed setae; tibio-patellar suture absent. Tarsi without setae dorsally; tarsal claws (Fig. 26) with a single row of 5 teeth increasing in length toward the apex, subapical pair of setae present. Second and third legs similar to foreleg, except tibio-patellar suture present.

Abdomen. Coloration of terga: 1-3 dark brown; 4-5 yellow; 6-7 dark brown; 8-9 yellow; 10 dark brown. Terga (Fig. 20) with scale and setal bases; posterior margin with broad, blunt spines. Sterna (Fig. 21) 1-7 yellow, without scale bases except laterally, smooth posterior margin without spines and with long thin setae irregularly arranged. Sterna 8-9 with pointed spines. Asymmetrical gills on abdominal segments 1 to 7; gill 1 (Fig. 22) reduced, without tracheation; gills 2-7 (Fig. 23) with dark tracheation, serrated with thin setae apically and posteriorly. Paraproct (Fig. 24) with about 17 pointed marginal spines; surface with about 25 scale bases, only in distal half; posterolateral extension with about 20 scale bases and with about 20 small spines along the margin.

ADULT: unknown.

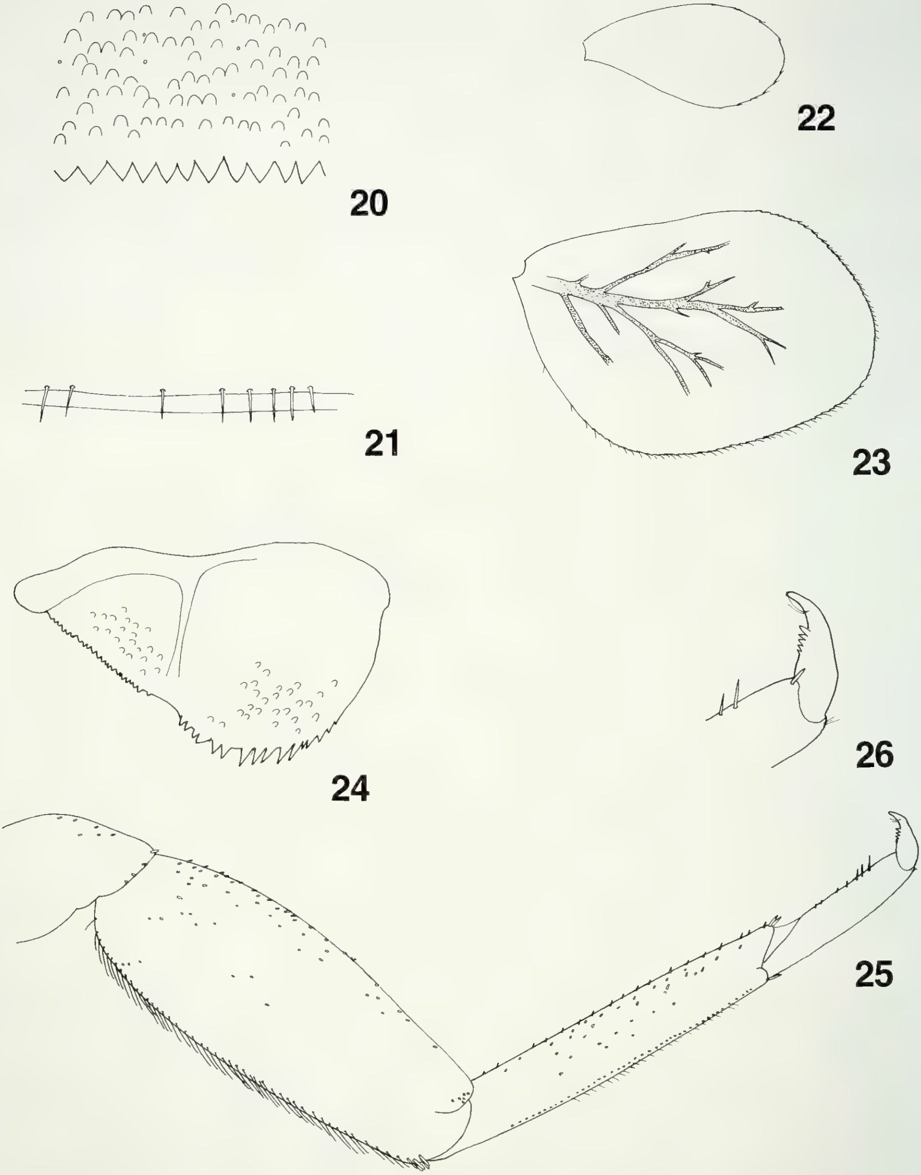
ETYMOLOGY

The specific epithet is Latin expressing the broad projection of the second segment of the labial palp.

Xyrodromeus sartorii sp. n. Figs 27-37

MATERIAL

Holotype: 1 larva (P0861), Madagascar, Rianila bas., trib. of Sahatandra Riv., Loc. near Ambalafotsy, road to Lakato, Long. 48°21’48” E, Lat. 19°02’40” S, Alt. 1050 m, 08.04.1999. Gattolliat, J.-L. and Raberiaka, N.



FIGS 20-26

Larval structures of *Xyrodromeus latipalpus*: 20: posterior margin of the fourth tergum. 21: posterior margin of the fourth sternum. 22: first gill. 23: fourth gill. 24: paraproct. 25: foreleg. 26: tarsal claw.

Paratypes: 2 female larvae 861c and 861d (on slides), and 147 larvae (P0861), same data as holotype. 4 larvae (P0514), same locality as holotype, 19.10.1995. Elouard, J.-M. and Pilaka, T. 3 larvae (P0693), same locality as holotype, 22.04.1997. Gattolliat, J.-L. and Raberiaka, N. 3 larvae (P0507), Madagascar, Rianila bas., trib. of Sahatandra Riv., Loc. near Ambalafotsy, road to Lakato, Long. 48°21'50" E, Lat. 19°03'30" S, Alt. 1075 m, 19.10.1995. Elouard, J.-M., Pilaka, T., Randriamasimanana, D. and Andriambelo, Z.P. 1 larva (P0723), same locality as P0507, 29.04.1998. Elouard, J.-M., Sartori, M., Raberiaka, N. and Oliarinony, R. 1 male larva 862b (on slide), 1 female larva 862c (on slide) and 8 larvae (P0862), Madagascar, Rianila bas., trib. of Sahatandra riv., Long. 48°21'51" E, Lat. 19°02'22" S, Alt. 1050 m, 08.04.1999. Gattolliat, J.-L. and Raberiaka, N. 2 larvae (P0722), Madagascar, Rianila bas., trib. of Sahatandra Riv., Loc. near Ambalafotsy, road to Lakato, Long. 48°21'38" E, Lat. 19°03'07" S, Alt. 1050 m, 29.04.1998. Elouard, J.-M., Sartori, M., Raberiaka, N., Oliarinony, R. 1 larva (P0760), same locality as P0723, 15.10.1998. Legrand, J. and Raberiaka, N.

Other material: 11 larvae (P0269), Madagascar, Mangoro bas., trib. of Ankeniheny riv., Loc. Réserve Manjakatompo Ankaratra, Long. 47°18'46" E, Lat. 19°21'23" S, Alt. 1700 m, 06.03.1995. Elouard, J.-M., Pilaka, T. and Blanc, L. 27 larvae (P0282), Madagascar, Mangoro bas., trib. of. Ankeniheny riv., Loc. Réserve Manjakatompo Ankaratra, Long. 47°17'50" E, Lat. 19°21'48" S, Alt. 1750 m, 10.03.1995. Pilaka, T. and Blanc, L. 1 larva (P0292), Madagascar, Sakanila bas., Lakato riv., Loc. road to Lakato, Long. 48°25'08" E, Lat. 19°08'33" S, Alt. 690 m, 20.03.1995. Blanc, L. 2 larvae (P0341), Madagascar, Mandrare bas., Marotoko riv., Loc. 2 km after Mananara, Long. 46°38'50" E, Lat. 24°44'02" S, Alt. 275 m, 03.06.1994. ORSTOM, Antananarivo. 1 larva (P0510), Madagascar, Mangoro bas., Manambolo riv., Loc. Mandraka, Long. 47°55'58" E, Lat. 18°55'17" S, Alt. 1050 m, 18.10.1995. Pilaka, T. 2 larvae (P0543), Madagascar, Manampanihy bas., Andranohela riv., Loc. Camp II Andohahela, Long. 46°44' 25" E, Lat. 24°35'47" S, Alt. 850 m, 26.11.1995. Elouard, J.-M. and Pilaka, T. 8 larvae (P0586), Madagascar, Mangoro bas., Ankeniheny riv., Loc. Temespoony, Long. 47°20'30" E, Lat. 19°22'27" S, Alt. 1580 m, 14.04.1996. Elouard, J.-M., Randriamasimanana, D. and Oliarinony, R. 17 larvae (P0587), Madagascar, Mangoro bas., Tsaratanana riv., Loc. Ankirihitra, Long. 47°17'37" E, Lat. 19°23'00" S, Alt. 1700 m, 14.04.1996. Elouard, J.-M., Randriamasimanana, D. and Oliarinony, R. 2 larvae (P0600), Madagascar, Mangoky bas., Manambaroa riv., Loc. 24 km from Amborompotsy, Long. 46°23'55" E, Lat. 20°37'10" S, Alt. 1100 m, 24.05.1996. Elouard, J.-M. 3 larvae (P0621), Madagascar, Lokoho bas., unnamed riv., Loc. Marojejy Camp II, Long. 49°45'33" E, Lat. 14°26'05" S, Alt. 750 m, 15.10.1996. Legrand, J. and Randriamasimanana, D. 2 larvae (P0623), Madagascar, Lokoho bas., Manantenina riv., Loc. Marojejy Camp II, Long. 49°45'37" E, Lat. 14°25'57" S, Alt. 720 m, 17.10.1996. Legrand, J. and Randriamasimanana, D. 2 larvae (P0628), Madagascar, Lokoho bas., trib. of Manantenina riv., Loc. Marojejy Camp II, Long. 49°45'57" E, Lat. 14°25'57" S, Alt. 730 m, 20.10.1996. Legrand, J. and Randriamasimanana, D. 2 larvae (P0728), Madagascar, Mangoro bas., trib. of Ankeniheny riv., Loc. Manjakatompo Ankaratra, Long. 47°18'46" E, Lat. 19°21'23" S, Alt. 1700 m, 30.04.1998. Elouard, J.-M. and Sartori, M. 3 larvae (P0741), Madagascar, Sakanila bas., Lakato riv., Loc. road to Lakato, Long. 48°24'51" E, Lat. 19°08'20" S, Alt. 720 m, 18.02.1999. Elouard, J.-M. and Raberiaka, N. 1 larva (P0818), Madagascar, Antongombato bas., Makis riv., Loc. Camp WWF, Long. 49°10'09" E, Lat. 12°31'40" S, Alt. 1080 m, 23.03.1999. Gattolliat, J.-L. and Rabeantoandro, Z. 27 larvae (P0872), Madagascar, Betaolana bas., Ambolokopatrika riv., Loc. Betaolana Camp 1, Long. 49°26'47" E, Lat. 14°32'25" S, Alt. 800 m, 08.10.1999. Doumenq E. 2 larvae (P0874), same locality as P0872, 09.10.1999. Doumenq E. 1 larva (P0877), same locality as P0872, 10.10.1999. Doumenq E. 35 larvae (P0893), Madagascar, Ampary bas., Anlanbe riv., Loc. Anjanaharibe S-W Camp1, Long. 49°26'53" E, Lat. 14°47'00" S, Alt. 1200 m, 26.10.1999. Doumenq E. 45 larvae (P0897), same locality as P0893, 27.10.1999. Doumenq E. 21 larvae (P0898), same locality as P0893, 30.10.1999. Doumenq E. 5 larvae (P0899), same locality as P0893, 31.10.1999. Doumenq E. 1 female larva 1009b and 31 larvae (P1009), Madagascar, Lokoho bas., Manantenina riv., Loc. Marojejy Camp2, Long. 49°45'58" E, Lat. 14°26'23" S, Alt. 800 m, 26.11.1999. Doumenq E. 10 larvae (P1020), Madagascar, Lokoho bas., Ambatomainty riv., Loc. Anjanaharibe-Sud Camp 2, Long. 49°27'70" E, Lat. 14°44'70" S, Alt. 1260 m, 07.12.1999. Doumenq E. 75 larvae (P1021), Madagascar, Lokoho bas., Marolakana riv., Loc. Anjanaharibe-Sud Camp 3, Long. 49°26’50” E, Lat. 14°44’50” S, Alt. 1550 m, 08.12.1999. Doumenq E.

LARVA

Maximum length: Body 7.1 mm. Cerci 5.6 mm and terminal filament 2.6 mm.

Head. Dark brown with broad yellow patterns between eyes and lateral ocelli, and between central ocellus and labrum, vermiform marks on vertex and frons poorly visible. Antennae pale cream yellow, except scape brown. Turbinate eyes purple-brown. Labrum (Fig. 27) subrectangular; distal margin with two row of setae, the longer row feathered; dorsal surface with an arc of about 20 long setae on each side, submedial pair of setae, few short setae in the proximal half; without setae ventrally. Hypopharynx as in figure 28, lingua not trilobate with minute thin setae.

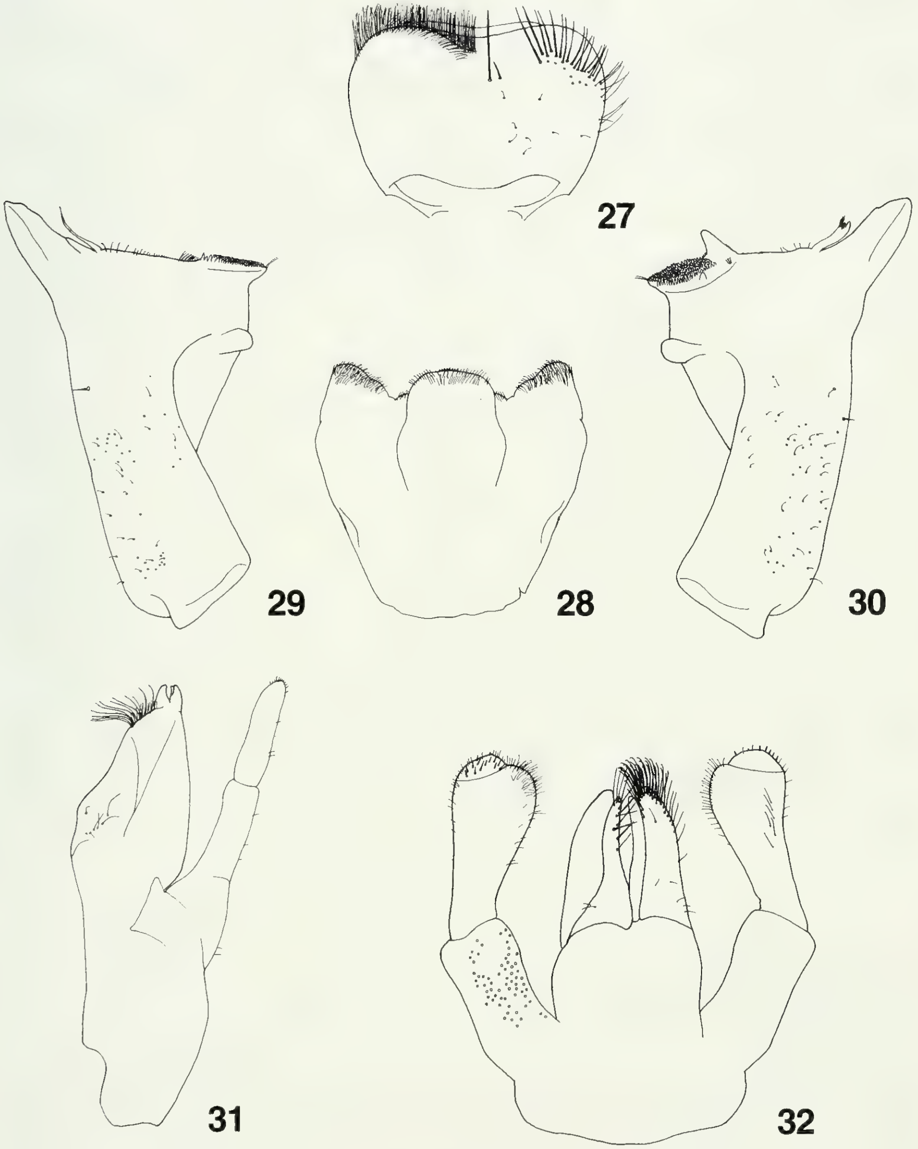
Right mandible (Fig. 29) with two sets of fused incisors, the inner one extremely reduced; prostheca reduced to a simple filament; a complete row of short setae between prostheca and mola; tuft of small setae near the mola; tuft of setae at the apex of the mola reduced to 2 setae; basal half with a stout seta perpendicular to the margin and abundant smaller setae dorsally.

Left mandible (Fig. 30) with completely fused incisors; prostheca with denticles and a comb-shape structure apically; scarce short setae between prostheca and mola; tuft of setae under the mola; tuft of setae at the apex of the mola reduced to 2 or 3 setae; basal half with a stout seta perpendicular to the margin and abundant small setae dorsally.

Maxillae (Fig. 31) with distal tooth opposed to the 3 others; 2 rows of setae, the first one formed by abundant small setae and the second by 4 long stout setae ending with 8 setae twice as long as the others, without pectinate or spine-like setae in the middle of the range; 6 setae at the base of the galea roughly arranged in a row; 1 single small seta perpendicular to the margin of the galea.

Labium (Fig. 32) with glossae and paraglossae subequal in length; apical half of the inner margin of glossae with stout setae, two small setae on the basal half; first segment of the labial palp 0.9 x length of the second and third combined; second segment with a rounded distomedial expansion, covered with numerous thin setae, row of 6 thin setae; third segment broad cap-like, with stout pointed setae apically.

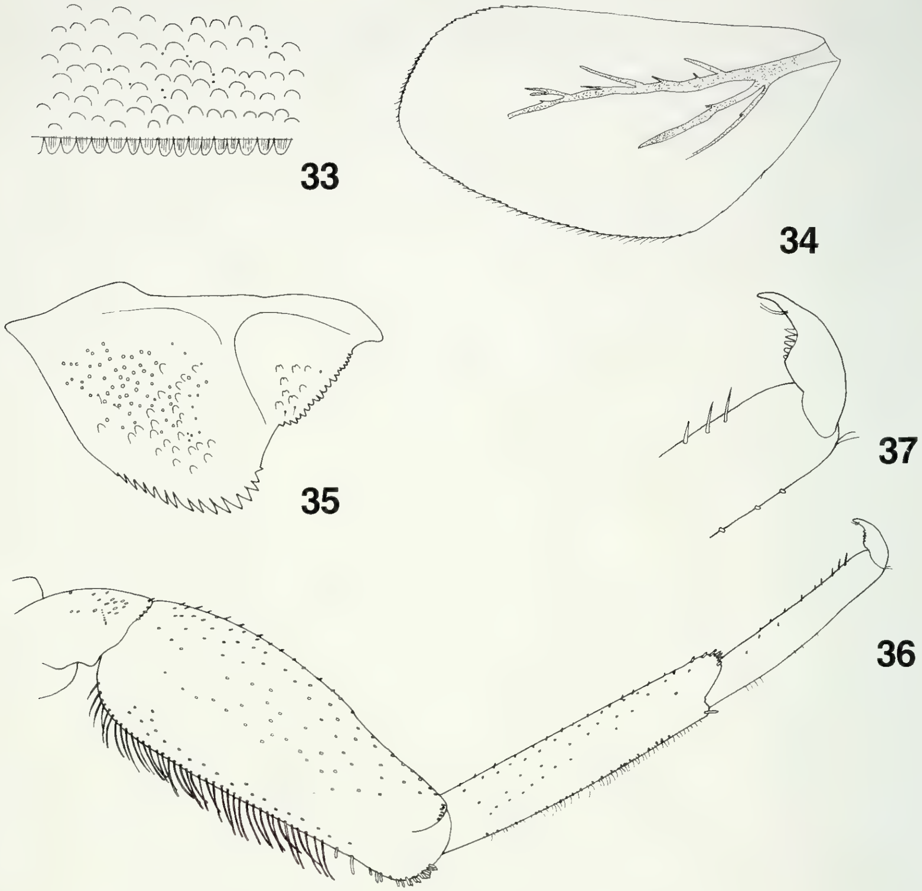
Thorax. Uniformly brown. Hindwing pad present. Legs coloration: femora brown with pale cream stripe subparallel to the dorsal margin; tibiae pale cream with inner margin darker; tarsi pale cream apically brown. Forelegs (Fig. 36). Coxae with small blunt setae. Femora dorsally with a row of long setae, scarce and short subapically; submarginal row of numerous minute setae; dorsoapical patch of several small broad setae; numerous, minute setae on the ventral and lateral margins. Tibiae dorsally with a row of minute blunt setae and some thin setae; apex dorsally with 1 long seta; ventral margin with minute pointed setae; tibio-patellar suture absent. Tarsi dorsally with few setae; tarsal claws (Fig. 37) with a single row of 5 teeth increasing in length, subapical pair of setae present. Second and third legs similar to foreleg, except tibio-patellar suture present.



FIGS 27-32

Larval structures of *Xyrodromeus sartorii*: 27: labrum (left: ventral; right: dorsal) 28: hypopharynx. 29: right mandible. 30: left mandible. 31: left maxilla. 32: labium.

Abdomen. Coloration of the terga: 1-3 brown; 4-5 yellow except margin brown; 6 brown; 7-8 brown with two yellow patterns; 9-10 brown. Terga (Fig. 33) with scale bases and few setae; posterior margin with broad, blunt spines. Sterna light



Figs 33-37

Larval structures of *Xyrodromeus sartorii*: 33: posterior margin of the fourth tergum. 34: fourth gill. 35: paraproct. 36: left foreleg. 37: tarsal claw.

brown, except 7-9 brown; sterna 1-6 with smooth posterior margin with a continuous row of setae without spines; sterna 7-9 with pointed spines. Asymmetrical gills (Fig. 34) on abdominal segments 2 to 7; dark tracheation poorly developed, serrated, with thin setae apically and posteriorly. Paraproct (Fig. 35) with about 15 pointed marginal spines; surface with about 25 scale bases and numerous setae insertions; posterolateral extension with about 8 scale bases and with about 18 small spines along the margin.

ADULTS: unknown.

ETYMOLOGY

This species is dedicated to the distinguished Ephemeropterologist M. Sartori.

Xyrodromeus namarona Lugo-Ortiz & McCafferty Figs 38-40

MATERIAL EXAMINED

1 male imago with corresponding larval skin 191a (on slide), Madagascar, Antongombato bas., Makis riv., Loc. Camp WWF, Long. 49°10'09" E, Lat. 12°31'40" S, Alt. 1075 m, 28.03.1994. Elouard, J.-M. and Sartori M. 1 male imago with corresponding larval skin 194a (on slide), same locality as 191a, 29.03.1994. Elouard, J.-M. and Sartori M. 1 male larva 200a (on slide) and 2 larvae (P0200), same locality as 191a, 02.04.1994. Elouard, J.-M. and Sartori M. 1 male larva 818g (on slide) and 6 larvae (P0818), same locality as 191a, 23.03.1999. Gattolliat, J.-L. and Rabeantoandro, Z. 1 female larva 826d (on slide) and 10 larvae (P0826), same locality as 191a, 25.03.1999. Gattolliat, J.-L. and Rabeantoandro, Z. 1 male larva 509-12 (on slide) and 2 larvae (P0509), Madagascar, Mangoro bas., Manambolo riv., Loc. Mandraka, Long. 47°56'10" E, Lat. 18°55'23" S, Alt. 1025 m, 18.10.1995. Randriamasimanana, D. and Andriambelo, Z.P. 1 male larva 158a (on slide), Madagascar, Mangoro bas., unnamed riv., Loc. Station forestière Mandraka, Long. 47°55'27" E, Lat. 18°54'49" S, Alt. 1200 m, 20.10.1995. Randriamasimanana, D. 1 male larva 641c (on slide) and 18 larvae (P0641), Madagascar, Namorona bas., Namorona riv., Loc. Ranomafana, Long. 47°27'18" E, Lat. 21°15'37" S, Alt. 725 m, 05.11.1996. Gibon, F.-M., Legrand, J., Gattolliat, J.-L., Rochat, C. and Randriamasimanana, D. 1 male larva 642-2 (on slide), Madagascar, Namorona bas., unnamed riv., Loc. Hotel Domaine nature, Long. 47°26'36" E, Lat. 21°15'07" S, Alt. 780 m, 06.11.1996. Legrand, J., Gattolliat, J.-L. and Randriamasimanana, D. 1 male larva 643a (on slide) and 5 larvae (P0643), Madagascar, Namorona bas., Ambatoaranana riv., Loc. Ranomafana village, Long. 47°27'26" E, Lat. 21°15'23" S, Alt. 770 m, 08.11.1996. Gattolliat, J.-L., Rochat, C. and Randriamasimanana, D. 1 female larva 822b, 1 male larva 822c (on slides) and 6 larvae (P0822), Madagascar, Antongombato bas., Makis riv., Loc. 100m from the Great Cascade, Long. 49°10'14" E, Lat. 12°29'17" S, Alt. 675 m, 24.03.1999. Gattolliat, J.-L. and Rabeantoandro, Z. 1 male larva 861e (on slide) and 79 larvae (P0861), Madagascar, Rianila bas., trib. of Sahatandra Riv., Loc. near Ambalafotsy, road to Lakato, Long. 48°21'48" E, Lat. 19°02'40" S, Alt. 1050 m, 08.04.1999. Gattolliat, J.-L. and Raberiaka, N. 23 larvae (P0862), Madagascar, Rianila bas., trib. of Sahatandra riv., Long. 48°21'51" E, Lat. 19°02'22" S, Alt. 1050 m, 08.04.1999. Gattolliat, J.-L. and Raberiaka, N. 1 male larva 870a, 1 female larva 870b (on slides) and 118 larvae (P0870), Madagascar, Tsiribihina bas., Sahatsio riv. (trib. of Mania riv.), Loc. Antsirabe, Long. 47°02'57" E, Lat. 19°49'55" S, Alt. 1500 m, 15.04.1999. Gattolliat, J.-L. and Doumenq, E.

LARVA: see Lugo-Ortiz & McCafferty, 1997.

MALE IMAGO

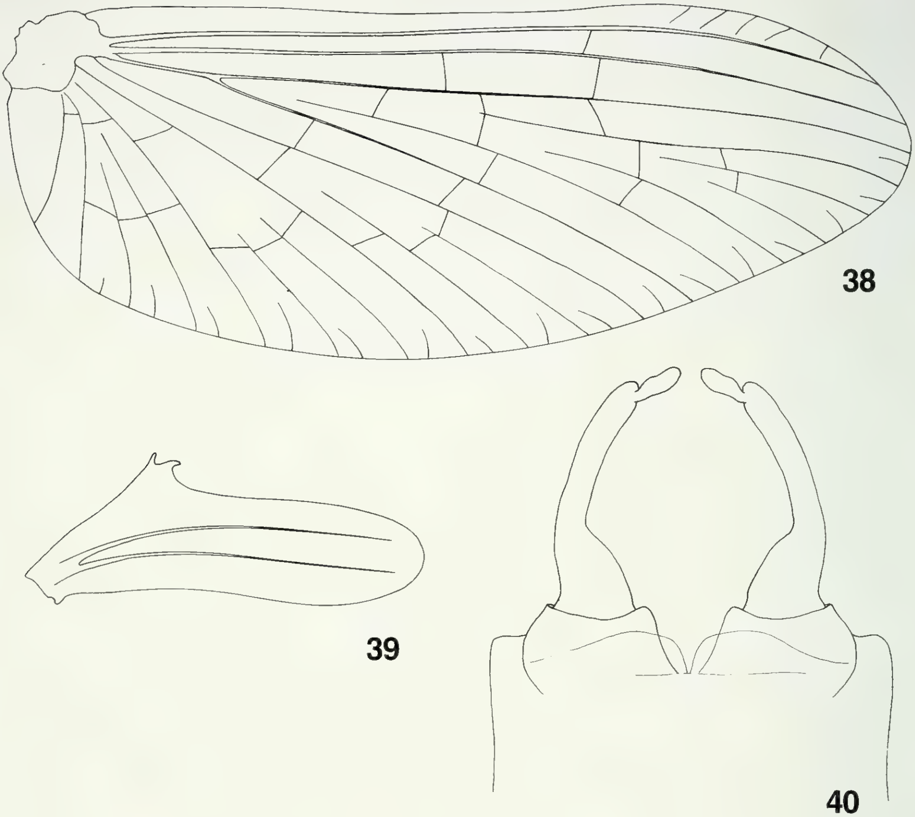
Maximum length: Body 6 mm. Cerci broken. Forewing 5.7 mm. Hindwing 0.8 mm.

Head. Light brown without marking. Turbinate eyes yellowish brown.

Thorax. Coppery brown. Forewing (Fig. 38) hyaline, with one relatively long intercalary vein between longitudinal veins except between subcostal and first radial veins; pterostigma with 5 to 8 vertical cross-veins that generally do not reach the subcostal vein. Hindwing (Fig. 39) hyaline with 2 distinct longitudinal veins, joined at the base; 2 distinct spurs on the costal margin.

Abdomen. Terga light brown with a proximal dark brown stripe proximally; sterna light brown.

Genitalia (Fig. 40) with 3-segmented gonopods, the limit between the first and the second barely visible. First segment stout, without setae; second segment with subparallel margins in apical 2/3; third segment elongate, outer margin incurved.



FIGS 38-40
Male imaginal structures of *Xyrodromeus namarona*: 38: forewing. 39: hindwing. 40: genitalia.

DISCUSSION

The three new species described herein clearly belong to the genus *Xyrodromeus*. They all possess the main characters of this genus such as: mandibles with bladelike incisors, second segment of the labial palp distomedially expanded, third segment of the labial palp short and nipple-like, villopore absent, tibiae and tarsi without an important row of setae and tarsal claws with a single row of teeth.

Xyrodromeus namarona, *X. modestus* and *X. latipalpus* constitute a very homogenous lineage. Important features such as the mandibles are almost identical among the three species (Figs 3, 4, 16, 17). The shape of the second segment of the labial palp and the width of the labrum show an interesting coevolution. *X. modestus* possesses a narrow labrum (Fig. 1) and a second segment of the labial palp weakly expanded distomedially (Fig. 6). At the opposite extreme, the labrum of *X. latipalpus* is very broad (Fig. 14) and the second segment of the labial palp is also broadly expanded (Fig. 18). *X. namarona* possesses intermediate features between the two species.

Xyrodromeus sartorii differs from the other species of the genus in that gills are absent from abdominal segment 1; the incisors of left mandible are fused in two sets instead of one (Fig. 29), the right prostheca is not slender (Fig. 30) and few setae are present on the dorsoapical margin of the femora (Fig. 36).

The description of these three new species of *Xyrodromeus* and especially the knowledge of the imaginal stage of *X. namarona* allow to complete the description of the genus and to clarify its relationships with other complexes of genera. The imagoes of *Xyrodromeus* can be diagnosed as follow: forewings with single intercalary between longitudinal veins; hindwing with 2 longitudinal veins and 2 distinct spurs on the costal margin, male genitalia 3-segmented without modification of second segment of gonopods and with the third segment elongated.

Xyrodromeus cannot belong to the *Bugilliesia* complex because it lacks a basomedial protuberance on the second segment of the male gonopods (Lugo-Ortiz & McCafferty, 1996). The forewings, the two distinct spurs on the costal margin of the hindwing and the shape of the gonopods of *Xyrodromeus* are identical with those of *Afroptilum* Gillies, *Herbrossus* McCafferty & Lugo-Ortiz and *Platycloeon* Gillies & Wuillot (Gillies, 1990; Gillies & Wuillot, 1997; Gattolliat & Sartori, 1998; Gattolliat *et al.*, 1999). All these genera belong to the Afrotropical *Centroptiloides* complex (Lugo-Ortiz & McCafferty, 1998a). If the imagoes of *Xyrodromeus* can be separated from the *Herbrossus* ones by the number of longitudinal veins of the hindwings, no reliable character distinguishes *Xyrodromeus* from species of *Afroptilum* and *Afroptiloides* in the imaginal stage (Gillies, 1990; Gattolliat *et al.*, 1999).

In the larvae, *Xyrodromeus* possesses a single row of teeth on the tarsal claws (Figs 13, 26, 37) instead of the double row found in other genera of the *Centroptiloides* complex (Lugo-Ortiz & McCafferty, 1998a). However, the reduction of the second row of teeth can be observed in other lineages of Baetidae, such as the genus *Afrobaetodes* (Gillies, 1991a; Gattolliat & Sartori, 1999a) and *Afroptiloides* (Gillies, 1991b; Gattolliat, 2000). This suggests that *Xyrodromeus* is more derived than other genera of the *Centroptiloides* complex. This hypothesis is confirmed by the high degree of specialization of the mouthparts for scraping.

KEY TO THE MALAGASY LARVAE OF *XYRODROMEUS*

1 Abdominal segment 1 without gills; dorsal margin of femora with a row of setae interrupted a quarter before the apex (Fig. 36) . . . . *Xyrodromeus sartorii* sp. n.

- Abdominal segment 1 with gills, although often very small (Fig. 1); dorsal margin of femora with an uninterrupted row of setae (Figs 12-25) . . . 2

2. Labrum narrow (Fig. 1); second segment of the labial palp weakly expanded distomedially (Fig. 6) . . . . *X. modestus* sp. n.

- Labrum broad (Fig. 14); second segment of the labial palp expanded distomedially (Fig. 18) 3

3 Labrum trapezoid, broader distally (Fig. 14); second segment of the labial palp with broadly rounded distomedial expansion (Fig. 18); prostheca reduced to a simple filament (Figs 16-17); terga well-contrasted yellow and brown . . . . *X. latipalpus* sp. n.

- Labrum subrectangular, as broad distally as proximally (Fig. 13, in Lugo-Ortiz & McCafferty, 1997); second segment of the labial palp with rounded distomedial expansion (Fig. 16, in Lugo-Ortiz & McCafferty, 1997); prostheca reduced to a bifid filament; terga generally uniformly light brown . . . . *X. namarona* sp. n. Lugo-Ortiz & McCafferty

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REFERENCES

GATTOLLIAT, J.-L. 2000. Three new species of *Afroptiloides* (Insecta : Ephemeroptera) and first report of this genus from Madagascar. *Mitteilungen der schweizerischen entomologischen Gesellschaft* 73: 305-315.

GATTOLLIAT, J.-L. 2001a. *Rheoptilum*: a new genus of two tailed Baetidae (Ephemeroptera) from Madagascar. *Aquatic Insects* 23 (1): 67-81.

GATTOLLIAT, J.-L. 2001b. The genus *Cloeodes* (Ephemeroptera: Baetidae) in Madagascar. *Revue suisse de Zoologie* 108(2): 387-402.

GATTOLLIAT, J.-L. & SARTORI, M. 1998. Two new Malagasy species of *Herbrossus* (Ephemeroptera: Baetidae) with the first generic description of the adults. *Annales de Limnologie* 34(3): 305-314.

GATTOLLIAT, J.-L. & SARTORI, M. 1999a. A new species of *Afrobaetodes* (Insecta : Ephemeroptera) and first report of this genus from Madagascar. *Annales de Limnologie* 35(3): 179-184.

GATTOLLIAT, J.-L. & SARTORI, M. 1999b. Revision of the Malagasy genus *Nesoptiloides* (Ephemeroptera: Baetidae). *Mitteilungen der schweizerischen entomologischen Gesellschaft* 72: 23-30.

GATTOLLIAT, J.-L. & SARTORI, M. 2000. Contribution to the systematics of the genus *Dabulamanzia* (Ephemeroptera: Baetidae) in Madagascar. *Revue suisse de Zoologie* 107(3): 561-577.

GATTOLLIAT, J.-L., SARTORI, M. & ELOUARD, J.-M. 1999. Aquatic Biodiversity from Madagascar 12: three new species of Baetidae (Ephemeroptera) from the Réserve Naturelle Intégrale d'Andohahela. *Fieldiana* 94: 115-124.

GILLIES, M. T. 1990. A revision of the African species of *Centroptilum* Eaton (Baetidae, Ephemeroptera). *Aquatic Insects* 12(2): 97-128.

GILLIES, M. T. 1991a. New records and a new species of *Afrobaetodes* Demoulin (Baetidae: Ephemeroptera) from Tanzania. *Revue d'Hydrobiologie tropicale* 24(2): 105-110.

GILLIES, M. T. 1991b. A new species of *Afroptilum* (*Afroptiloides*) from East Africa (Ephem., Baetidae). *Entomologist's Monthly Magazine* 127: 109-115.

GILLIES, M. T. & WUILLOT, J. 1997. *Platycloeon*, a new genus of Baetidae (Ephemeroptera) from East Africa. *Aquatic Insects* 19: 185-189.

LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1996. The *Bugilliesia* complex of African Baetidae (Ephemeroptera). *Transactions of the American Entomological Society* 122(4): 175-197.

LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1997. New Afrotropical genus of Baetidae (Insecta: Ephemeroptera) with bladelike mandibles. *Bulletin de la Société d'Histoire Naturelle de Toulouse* 133: 41-46.

LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1998a. The *Centroptiloides* Complex of Afrotropical small minnow mayflies (Ephemeroptera: Baetidae). *Annals of the Entomological Society of America* 91(1): 1-26.

LUGO-ORTIZ, C. R. & MCCAFFERTY, W. P. 1998b. Phylogeny and biogeography of *Nesydemius*, n. gen., and related Afrotropical genera (Insecta : Ephemeroptera : Baetidae). *Bulletin de la Société d'Histoire Naturelle de Toulouse* 134: 7-12.

WALTZ, R. D. & MCCAFFERTY, W. P. 1987a. Generic revision of *Cloeodes* and description of two new genera (Ephemeroptera: Baetidae). *Proceedings of the Entomological Society of Washington* 89(1): 177-184.

WALTZ, R. D. & MCCAFFERTY, W. P. 1987b. Revision of the genus *Cloeodes* Traver (Ephemeroptera: Baetidae). *Annals of the Entomological Society of America* 80(2): 191-207.

WALTZ, R. D. & MCCAFFERTY, W. P. 1987c. Systematics of *Pseudocloeon*, *Acentrella*, *Baetiella* and *Liebebiella* (Ephemeroptera: Baetidae). *Journal of the New York Entomological Society* 87: 553-568.

REVUE SUISSE DE ZOOLOGIE 109 (2): 343-354; juin 2002

Changements de la composition et de la structure des peuplements de mollusques de la partie nord du lac d'Annecy (Savoie, France) entre les années 1929-1939 et l'époque actuelle

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Changes in the composition and the structure of mollusc communities of the north part of Annecy Lake (Savoie, France) between the years 1929-1939 and the present period. - Between the years 1929-1939, mollusc communities of the north part of Annecy Lake were collected by Favre. After a study of his collection, malacological sampling were carried out in the same sites. A comparison of Favre's data with present data shows that: significant changes in the composition and the structure of the communities occurred between these two periods; improvement effects of the physico-chemical quality due to the sewerage system construction, which began in 1961, were more efficient on the littoral zone communities than on those of the deep waters zone; several species colonized the Annecy lake, three of them *Dreissena polymorpha, Pisidium moitessierianum* and *Potamopyrgus antipodarum* being abundant in the north part of the lake. The recent arrival of *P. moitessierianum,* which normally only lives in large lakes of the plain and in the potamon of rivers, unlike the others *Pisidium* of Annecy, could be a result of the climatic change.

Key-words: molluscs - lake - community changes - Annecy.

INTRODUCTION

Les premières données concernant les mollusques du lac d'Annecy figurent dans les travaux de Forel (1884), puis de Le Roux (1907-1908). Plus tard, sans doute entre les années 1929 et 1939, une vingtaine de dragages ont été réalisés par Favre dans la partie nord du lac. Cette collection déposée au Muséum d'histoire naturelle de Genève n'avait jamais, jusqu'ici, fait l'objet de publication; seule la présence ou l'absence de certaines espèces sont évoquées dans un cours paragraphe traitant de la comparaison des faunes malacologiques d'Annecy et du Bourget (Favre, 1940). Dans sa publication sur la faune profonde du Léman et d'Annecy, Juget (1958), fait également mention de la présence de mollusques dans ces milieux. Contrairement à ceux de ses deux grands voisins savoyards, le Léman et le Bourget (Favre, 1927; 1940), les peuplements de mollusques du lac d'Annecy sont donc restés mal connus jusqu'à la

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fin du siècle dernier. C'est récemment en effet qu'un inventaire des malacocénoses littorales du lac a pu être réalisé dans le cadre de recherches sur la dermatite cercarienne (Mouthon & Dubois, 2001).

Au cours de la première moitié du siècle dernier, la pollution du lac devenant de plus en plus préoccupante (Hubault, 1947), la décision de construire un collecteur des eaux usées qui se déversaient dans le plan d'eau fut prise en 1957. La réalisation de cet ouvrage qui, en premier lieu, de 1961 à 1964, a concerné l'agglomération d'Annecy, s'étant achevée en 1998 par la partie sud du lac, il était donc intéressant de comparer les relevés malacologiques effectués par Favre dans les années 1929-1939 aux données actuelles. Cet article a pour double but de: 1°/ compléter l'inventaire réalisé dernièrement, notamment par des prospections dans la zone profonde du lac; 2°/ décrire les changements dans la composition et la structure des peuplements colonisant la partie nord du plan d'eau, qui sont intervenus entre 1929-1939 et l'époque actuelle, afin de disposer d'éléments d'interprétation de l'évolution de l'état biologique du lac.

MATERIEL ET METHODES

Le lac d'Annecy est situé dans le département de la Haute-Savoie, à une altitude de 446 m. Il occupe une superficie de 27,04 km^2. Ses principales caractéristiques morphométriques sont les suivantes: longueur totale 14,6 km, largeur maximale 3,5 km, profondeur maximale, hors Boubioz, 64,7 m.

Le choix des sites prospectés s'est effectué à partir des indications figurant sur les étiquettes accompagnant les échantillons de la collection Favre (Fig. 1). Toutefois, celui-ci ne fût pas toujours aisé. En effet, compte tenu des importants travaux d'aménagements du littoral qui ont été effectués au cours du siècle dernier, les ceintures végétales, comme la roselière d'Albigny utilisée comme point de repère par Favre, ont fortement régressé et les lieux mentionnés, comme le port des platanes, ont parfois disparu. Dans ce dernier cas, l'échantillonnage a été réalisé à son emplacement supposé. Parmi les isobathes échantillonnées par Favre, seule la profondeur de -8 m, face à la phragmitaie entre Albigny et Talabor n'a pu être prospectée: l'épaisseur trop importante des characées ne permettant pas à la benne d'atteindre la couche de sédiment sous-jacente. Dans ce secteur, l'échantillonnage n'a pu être réalisé qu'entre -5 et -6 m.

Le protocole et le matériel d'échantillonnage utilisés par Favre pour prospecter la partie nord du lac sont inconnus. Cependant, on peut raisonnablement supposer qu'il utilisa le même engin qui lui servit à étudier la faune malacologique du lac du Bourget à savoir: "une drague triangulaire de 36 cm de côté, pourvue d'un filet à mailles de 0,8 mm" (Favre, 1940). Les échantillons de cette collection ont été examinés et comptabilisés. Les abondances obtenues au niveau de chaque site ont ensuite été transformées en pourcentages. Les dates de prospection de la vingtaine de dragages réalisés sont également inconnues, aucune indication concernant ce sujet ne figurant dans ces différents travaux. Toutefois, ces dates se situent vraisemblablement entre la parution de ses ouvrages sur les mollusques du Léman et ceux du Bourget, soit entre les années 1929 et 1939.

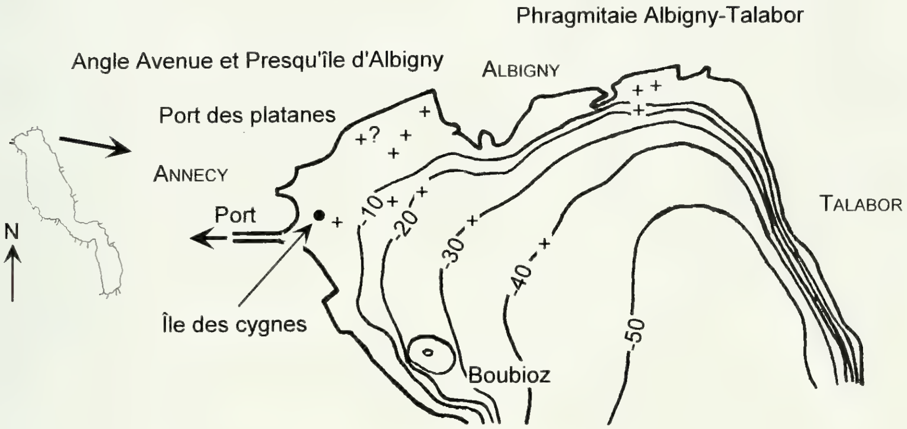


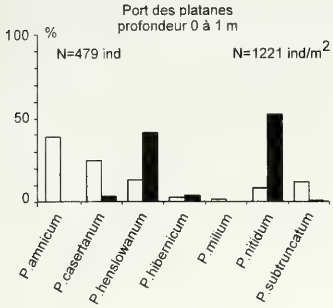
FIG. 1
Situations probables des sites prospectés par Favre dans les années 1929-1939 et au niveau desquels fut réalisé l'échantillonnage des mollusques en 2000 et 2001.

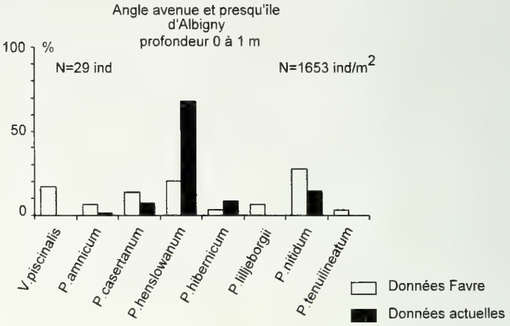
Les mollusques actuels ont été récoltés: entre 0 et -1 m, à l'aide d'un troubleau à base rectangulaire (25 x 18 cm, vide de maille 630 µm); une surface de 1 à 2 m^2 étant échantillonnée suivant les stations; entre -1,5 et -40 m, à l'aide d'une benne type Van Veen (S= 250 cm^2), cinq prélèvements réunis dans un seul échantillon étant réalisés sur chaque site. Les échantillons furent tamisés à 630 µm, puis triés et déterminés à l'aide d'une loupe binoculaire. Les effectifs des espèces, sur chaque site, ont ensuite été rapportés au m^2 puis transformés en % pour pouvoir être comparées aux relevés de Favre. Les prélèvements ont été réalisés au cours des deux premières semaines de juin 2000 et de la troisième semaine de juillet 2001.

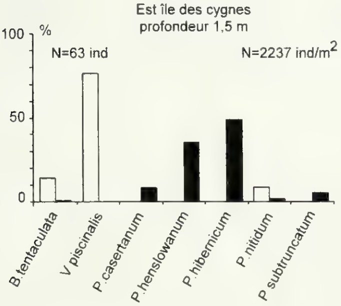
RESULTATS

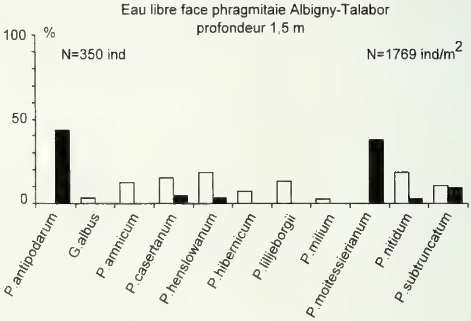
La surface des dragages réalisés par Favre n'étant pas connue, seuls l'ordre de grandeur des effectifs et l'abondance relative des espèces, en termes de pourcentage, au niveau de la zone littorale puis des zones sublittorale et profonde de la partie nord du lac d'Annecy ont fait l'objet de comparaisons avec les données actuelles (Tab. 1).

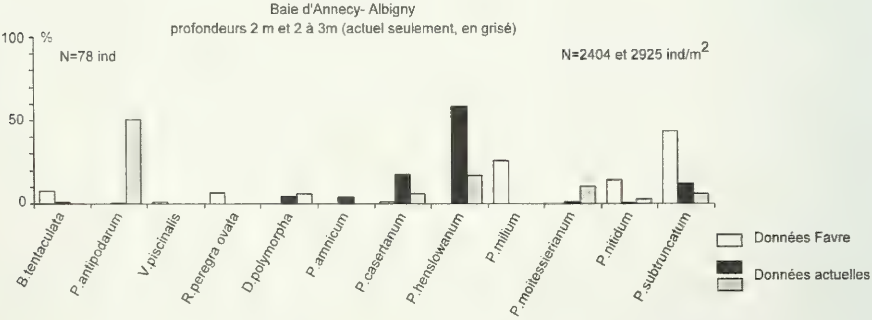
FIG. 2
Changements de la composition et de la structure des peuplements de mollusques de la zone littorale (de 0 à 8 m de profondeur) entre 1929-1939 et l'époque actuelle. Seules sont prises en compte les espèces représentées par plus de 1 % des peuplements, au moins à une des deux périodes d'échantillonnage. Les nombres d'individus récoltés (N) sont indiqués à droite (données Favre) et à gauche de l'histogramme (données actuelles).

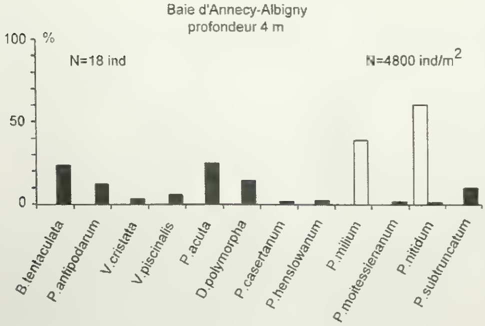

Port des platanes
profondeur 0 à 1 m

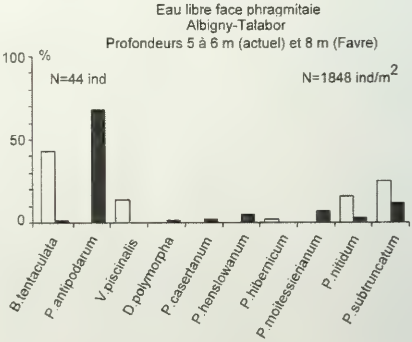

Angle avenue et presqu'île
d'Albigny
profondeur 0 à 1 m


Est île des cygnes
profondeur 1,5 m


Eau libre face phragmitaie Albigny-Talabor
profondeur 1,5 m


Baie d'Annecy- Albigny
profondeurs 2 m et 2 à 3m (actuel seulement, en grisé)


Baie d'Annecy-Albigny
profondeur 4 m


Eau libre face phragmitaie
Albigny-Talabor
Profondeurs 5 à 6 m (actuel) et 8 m (Favre)

ZONE LITTORALE (de 0 à -8 m)

Dans les années 1925-1935, on constate que les peuplements de mollusques sont plutôt mal représentés dans la zone littorale du lac. En effet, sur cinq des sept sites littoraux prospectés par Favre, les abondances relevées sont inférieures à 100 individus. En revanche, les prélèvements effectués sur ces mêmes sites en 2000 et 2001 montrent que les mollusques, et particulièrement les Sphaeriidae, sont très abondants dans la zone littorale; les densités/m^2 relevées étant comprises entre 1221 et 4800 ind/m^2 (Fig. 2).

On observe également une forte variabilité de la structure des peuplements d'un site à l'autre aussi bien à l'époque de Favre, où l'on rencontre 7 espèces dominantes différentes pour 7 sites étudiés, qu'actuellement avec 5 espèces dominantes pour 7 sites. Au niveau d'une même station, cette variabilité est également importante lorsque l'on compare les deux époques de prospection. L'exemple le plus représentatif de cette variabilité temporelle est illustré par les peuplements de la baie d'Albigny, par -4 m. Favre n'avait récolté sur ce site que quelques individus (N= 18) de *Pisidium milium* et *P. nitidum.* Actuellement, cette station, colonisée par les characées, héberge un peuplement dense (N= 4800 ind/m^2) et riche en espèces (N= 17 sp), dominé par *Physella acuta*, *Bithynia tentaculata* et *Dreissena polymorpha,* mais contrairement aux autres sites, les Sphaeriidae y sont peu abondants.

Parmi les espèces les mieux représentées à l'époque de Favre, c'est *Pisidium nitidum* que l'on retrouve le plus fréquemment, mais les peuplements actuels sont surtout dominés par *Potamopyrgus antipodarum* et *Pisidium henslowanum.* Cette dernière, que Favre n'avait récoltée que sur 3 des 7 sites prospectés est actuellement bien représentée dans toute la zone littorale de la partie nord du lac, notamment au niveau des sites baie d'Albigny, par -2 m, et à l'angle de l'avenue presqu'île d'Albigny, où elle constitue respectivement 58,4 % et 68 % des peuplements.

ZONES SUBLITTORALE (-12 m) ET PROFONDE (-20 à -40 m)

Dans la baie d'Annecy-Albigny, à la profondeur de 12 mètres, on observe comme dans la zone littorale une forte variabilité dans la composition et la structure des peuplements (Fig. 3). A l'époque de Favre, les malacocénoses sont dominées par *Pisidium subtruncatum* et *P. henslowanum* et parmi les gastéropodes, seul *Valvata piscinalis* est bien représenté. De nos jours, c'est *Dreissena polymorpha* dont les juvéniles pullulent sur les characées qui, avec 89,1 % de l'effectif total, domine les peuplements. *Physella acuta* et *Pisidium tenuilineatum* sont encore présents mais *V. piscinalis,* généralement plus eurybathe que ces derniers, n'est plus représenté à cette profondeur, ni dans les échantillons récoltés par -15 m (Tab. 1; Fig. 3).

A partir de 20 m de profondeur, 5 espèces sont significativement présentes en plus d'un seul exemplaire de *Pisidium lilljeborgii* récolté par Favre dans la baie d'Annecy à -30 m (Tab. 1). Il s'agit des gastéropodes *Valvata piscinalis* (baie d'Annecy par -20 m) et *Radix peregra (ovata) profunda* (entre Albigny et Talabor par -40 m), des bivalves *Pisidium casertanum*, *P. conventus* et *P. personatum*; les deux derniers colonisent classiquement la zone profonde des grands lacs alpins (Favre, 1927; 1940; Kuiper, 1966; Meier-Brook, 1975). Récolté par Favre aux profondeurs de

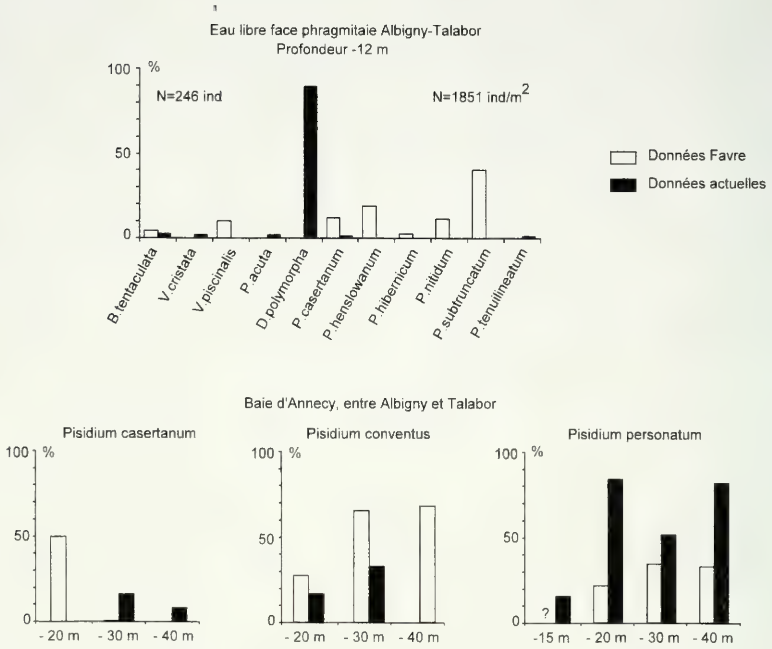


FIG. 3

Changements de la composition et de la structure des peuplements de mollusques de 12 à 40 m de profondeur entre 1929-1939 et l'époque actuelle. Seules sont prises en compte les espèces représentées par plus de 1 % des peuplements, au moins à une des deux périodes d'échantillonnage. Les nombres d'individus récoltés (N) sont indiqués à droite (données Favre) et à gauche de l'histogramme (données actuelles).

12 et 20 m, *V. piscinalis* ne figure pas dans les prélèvements actuels réalisés aux mêmes isobathes. Par ailleurs, la forme *profunda* de *Radix peregra (ovata)*, qui est représentée par 4 coquilles vides dans la collection de Favre, colonise encore de nos jours la zone profonde du lac: plusieurs exemplaires vivants ont été récoltés par -40 m (Tab. 1).

Lorsque l'on examine l'évolution temporelle de l'abondance relative (%) de ces trois espèces de bivalves en fonction de la profondeur (Fig. 3), on constate que: *Pisidium casertanum* qui, à l'époque de Favre, était abondant à - 20 m, puis disparaissait presque totalement à - 30 m, est aujourd'hui présent jusqu'à 40 m de profondeur; *P. conventus* était beaucoup plus abondant que son congénère *P. personatum* dans la zone profonde de la partie nord du lac dans les années 1929-1939. De nos jours, on observe le phénomène inverse: *P. personatum,* que l'on trouve dès -15 m, est beaucoup plus abondant que *P. conventus,* dont l'amplitude bathymétrique s'est réduite puisqu'on ne le trouve plus au-delà de 30 m de profondeur.

Les effectifs des peuplements récoltés par Favre dans la zone profonde, notamment à -30 et -40 m, respectivement n= 681 et 546 individus (Tab. 1) sont nettement plus élevés que ceux relevés dans la zone littorale dont la moyenne pour les

TABLEAU 1: Liste et abondance relative (%) des espèces de mollusques récoltées en 1929-1939 (collection Favre - chiffres en caractère droit) et en 2000-2001 (chiffres en italique). ( ) : nombre de coquilles vides non comptabilisées.

Stations	Port des platanes (bordure)		Angle avenue et presqu'île d'Albigny (bordure)		Est île des cygnes -1.5m		Eau libre face phragmitaie Aligny-Talabor			
							-1.5m		-5 à -6m	- 8m
Bithynia tentaculata (L.)	0.8				14.3	*0.3*			*1.5*	43.2
Potamopyrgus antipodarum (Gray)								*43.1*	*68.1*	
Valvata cristata (Müller)		*0.1*					(3)	*0.1*		
Valvata piscinalis (Müller)		*0.1*	17.2		76.2		(2)			13.6
Radix peregra ovata (Müller)	(1)			*0.1*			0.3			
Radix peregra fr.*profunda*										
Armiger crista (L.)										
Gyraulus albus (Müller)							3.1			
Gyraulus laevis (Alder)										
Planorbis carinatus Müller										(3)
Physella acuta (Draparnaud)										
Dreissena polymorpha (Pallas)						*0.3*			*1.5*	
Anodonta anatina (L.)							0.3			
Anodonta cygnea (L.)										
Unio pictorum (L.)										
Musculium lacustre (Müller)	0.2							*0.3*		
Sphaerium corneum (L.)	0.2						0.3			
Pisidium amnicum (Müller)	38.0		6.9	*1.6*			12.3	*0.1*		
Pisidium casertanum (Poli)	24.4	*3.1*	13.8	*7.1*		*8.2*	14.9	*4.3*	*2.1*	
Pisidium conventus Clessin										
Pisidium henslowanum (Sheppard)	12.5	*40.6*	20.7	*67.9*		*35.4*	18.0	*3.1*	*5.2*	
Pisidium hibernicum Westerlund	2.7	*3.5*	3.4	*8.7*		*48.8*	6.9	*0.1*		2.3
Pisidium lilljeborgii Clessin	0.2		6.9	*0.1*			13.1			
Pisidium milium Held	1.3	*0.1*					2.6	*0.1*		
Pisidium moitessierianum (Paladihle)								*37.0*	*6.7*	
Pisidium nitidum Jenyns	8.1	*51.8*	27.6	*14.3*	9.5	*1.9*	18.0	*2.8*	*3.1*	15.9
Pisidium personatum Malm										
Pisidium subtruncatum Malm	11.5	*0.5*		*0.3*		*5.2*	10.6	*9.2*	*11.8*	25
Pisidium tenuilineatum Stelfox		*0.2*	3.4					*0.1*		
Richesse spécifique	**11**	***9***	**8**	***8***	**3**	***7***	**12**	***12***	***8***	**5**
Total (données Favre)	**479**		**29**		**63**		**351**			**44**
Total/m2 (données actuelles)		***1221***		***1653***		***2237***		***1769***	***1841***	

TABLEAU 1 (suite): Liste et abondance relative (%) des espèces de mollusques récoltées en 1929-1939 (collection Favre - chiffres en caractère droit) et en 2000-2001 (chiffres en italique). ( ) : nombre de coquilles vides non comptabilisées.

Stations	Baie d'Annecy Albigny							Baie d'Annecy					Entre Albigny et Talabor	
			Entrée port											
	- 2m		-2-3m	- 4m		-12m		-15m	- 20m		-30m		-40m	
Bithynia tentaculata (L.)	7.7	*1.3*	*0.2*		*23.8*	4.5	*2.3*							
Potamopyrgus antipodarum (Gray)		*0.5*	*50.5*		*11.8*	(1)								
Valvata cristata (Müller)					*3.2*		*1.7*							
Valvata piscinalis (Müller)	1.3				*5.0*	10.2			1.3					
Radix peregra ovata (Müller)	6.4			(1)		(1)								
Radix peregra fr.*profunda*													(4)	*5.6*
Armiger crista (L.)					*0.6*									
Gyraulus albus (Müller)														
Gyraulus laevis (Alder)					*0.1*									
Planorbis carinatus Müller														
Physella acuta (Draparnaud)					*24.9*		*2.0*							
Dreissena polymorpha (Pallas)		*4.6*	*5.9*		*14.2*		*89.1*	*20.5*						
Anodonta anatina (L.)														
Anodonta cygnea (L.)			*0.1*		*0.04*									
Unio pictorum (L.)		*0.04*												
Musculium lacustre (Müller)														
Sphaerium corneum (L.)														
Pisidium amnicum (Müller)		*3.8*	*0.2*		*0.5*									
Pisidium casertanum (Poli)	1.3	*17.6*	*6.3*		*1.1*	11.8	*1.0*		50.0		0.6	*16.3*		*8.4*
Pisidium conventus Clessin									26.9	*16.2*	64.5	*32.1*	67.2	
Pisidium henslowanum (Sheppard)		*58.4*	*17.0*		*1.7*	18.7								
Pisidium hibernicum Westerlund			*0.6*		*0.4*	2.4								
Pisidium lilljeborgii Clessin											0.1			
Pisidium milium Held	25.6			38.9		0.8								
Pisidium moitessierianum (Paladihle)		*1.0*	*10.3*		*1.3*									
Pisidium nitidum Jenyns	14.1	*0.5*	*2.7*	61.1	*1.5*	11.4								
Pisidium personatum Malm								*15.4*	21.9	*83.8*	34.8	*51.6*	32.8	*86.0*
Pisidium subtruncatum Malm	43.6	*12.2*	*6.3*		*9.5*	40.2	*2.6*	*53.8*						
Pisidium tenuilineatum Stelfox					*0.5*		*1.3*	*10.3*						
Richesse spécifique	**7**	***9***	***11***	**2**	***17***	**8**	***7***	***4***	**4**	***2***	**4**	***3***	**2**	***3***
Total (données Favre)	**78**			**18**		**246**			**160**		**681**		**546**	
Total/m2 (données actuelles)		***2404***	***2925***		***4800***		***1851***	***370***		***37***		***190***		***214***

7 sites est de 152 individus. En revanche, les malacocénoses actuelles présentent des densités beaucoup plus élevées dans la zone littorale (moyenne= 2356 ind/m^2) que dans la zone profonde où les effectifs maxima que l'on rencontre à la profondeur de 40 m n'atteignent que 212 ind/m^2.

DISCUSSION

Les prélèvements effectués au cours du mois de juillet 2001 ont permis de préciser plusieurs points par rapport à l'inventaire réalisé en juin 2000 (Mouthon & Dubois, 2001). *Pisidium lilljeborgii* et le genre *Anodonta* que Le Roux (1907-1908) trouvait "en quantité sur la beine nord et parmi les roseaux d'Albigny", qui n'avaient pas été récoltés précédemment, sont toujours présents dans la partie nord du lac. Toutefois, *Anodonta anatina,* seule espèce inventoriée par Favre, semble avoir disparu du lac et a été remplacée par sa congénère *A. cygnea,* et *P. lilljeborgii* n'a été rencontré qu'à un seul exemplaire au niveau du site angle de l'avenue presqu'île d'Albigny. Les peuplements littoraux peuvent localement être dominés à la fois par *Potamopyrgus antipodarum* et par d'autres espèces de gastéropodes comme c'est le cas dans la baie d'Annecy-Albigny à -4 m, où les characées hébergent également des populations abondantes de *Physella acuta*, *Bithynia tentaculata* et de *Valvata. P. acuta* est encore présent à -12 m.

La comparaison entre les données récoltées par Favre dans la partie nord du lac d'Annecy dans les années 1929-1939 et les relevés actuels montre que des changements importants dans la composition et la structure des peuplements de mollusques se sont produits entre ces deux périodes. En effet, on observe une grande variabilité temporelle de cette structure s'exprimant notamment par un remplacement systématique des espèces dominantes sur quasi tous les sites, tant dans la zone littorale que profonde. La variabilité spatiale de cette structure des peuplements qui était élevée à l'époque de Favre l'est toujours de nos jours: la ou les espèces dominantes sont différentes d'un site à l'autre. Ce phénomène, qui concerne d'ailleurs l'ensemble du plan d'eau, comme l'a montré l'inventaire réalisé dans la zone littorale du lac (Mouthon & Dubois, 2001), constitue sans doute une expression de l'hétérogénéité des habitats sédimentaires et des conditions qui y règnent.

Depuis les relevés de Le Roux (1907-1908) et ceux de Favre, la composition faunistique du lac d'Annecy s'est enrichie de plusieurs autres espèces. Il s'agit de *Dreissena polymorpha, Potamopyrgus antipodarum, Physella acuta, Gyraulus laevis* qui semble avoir remplacé *G. albus* dans la partie nord du lac, *Menetus dilatatus* récoltée précédemment au niveau de Duingt et *Pisidium moitessierianum* (Mouthon & Dubois, 2001). L'apparition de cette pisidie présente un intérêt tout particulier. En effet, cette espèce qui vit seulement dans les lacs de faible altitude (Favre, 1940, 1941; Walter & Kuiper, 1978; Mouthon, 1990) et au niveau du potamon des cours d'eau, où elle atteint son preferendum (Meier-Brook, 1975; Mouthon, 1981, 1999), a besoin d'une température plus élevée pour se développer que les autres espèces de Sphaeriidae rencontrées à Annecy. Sa large représentation dans la zone littorale du lac (Mouthon & Dubois, 2001) pourrait être une conséquence du récent réchauffement climatique (Houghton *et al.*, 1996). L'observation de ce phénomène sur d'autres plans d'eau pourrait permettre de confirmer cette hypothèse.

Dans les années 1929-1939, lorsque Favre a réalisé ses dragages dans la partie nord du lac d'Annecy, l'abondance des peuplements de mollusques était faible dans la zone littorale mais, au contraire, importante dans la zone profonde entre -20 et -40 m. De nos jours, la densité des peuplements est très forte dans la zone littorale et beaucoup plus faible dans la zone profonde. Cette forte densité des malacocénoses littorales actuelles est, sans nul doute, consécutive à l'amélioration de la qualité physico-chimique des eaux qui a suivi la mise en service progressive du collecteur des eaux usées. Cependant, en ce qui concerne la zone profonde de -20 à -40 m, les changements observés dans la structure des peuplements entre les deux périodes d'échantillonnage sont plus délicats à interpréter; deux faits marquants s'en dégagent.

– L'absence d'individu vivant de la forme *profunda* de *Radix peregra* (*ovata*) dans la collection de Favre où ne figurent que des coquilles vides (4 exemplaires). Néanmoins, on remarquera que trois d'entre elles sont encore munies de leur épiderme et étaient, par conséquent, mortes peu de temps avant d'avoir été prélevées; le quatrième spécimen, sans épiderme et donc entièrement blanc, est plus ancien. Par ailleurs, cette forme signalée par Forel (1884) par -50 m, puis par Le Roux (1907-1908) par -42 m, était encore présente dans les prélèvements effectués à -35 et -45 m par Juget (1958), bien avant la mise en service de la première tranche du collecteur. Il est donc fort probable que ce gastéropode ait toujours été présent dans la zone profonde du lac.

– Le changement de la structure des peuplements profonds. Dans les années 1929-1939, les malacocénoses de la zone profonde étaient largement dominées par *Pisidium conventus* qui représentait plus de 60 % des effectifs à -30 et -40 m. En revanche, de nos jours, *Pisidium personatum,* espèce résistante à la pollution (Mouthon, 1996) et moins sensible dans la zone profonde des lacs que sa congénère (Mouthon, 1992b), est devenue l'espèce dominante, représentant plus de 80 % des effectifs à -20 et -40 m. Une des causes probables de ce changement est à rechercher dans les effets de l'installation de conditions anoxiques, de juin à novembre, dans les couches profondes (au delà de -50 m) de l'hypolimnion (Balvay, 1967-1968a et 1967-1968b; 1986), susceptibles de limiter le développement de l'espèce la plus sensible *P. conventus*; au contraire, la présence de sources sous-lacustres favorisait la colonisation des fonds par l'espèce d'eau souterraine *P. personatum* (Kuiper, 1966; Meier-Brook, 1975; Mouthon & Kuiper, 1987).

Ces observations montrent que les effets de l'amélioration de la qualité physico-chimique des eaux qui s'est produite après la mise en service progressive du collecteur se sont fait sentir plus rapidement sur les malacocénoses de la zone littorale que sur celles de la zone profonde, jusqu'à -40 m. Cependant, le maintien de peuplements de mollusques dans cette dernière, même si leur structure a fortement changé entre les deux périodes d'échantillonnage, démontre que le déficit en oxygène dissous n'a vraisemblablement jamais été un facteur limitant, au moins jusqu'à -40 m (cf. Mouthon, 1992a et 1992b; 1993). En effet, en raison de sa morphométrie, le mélange des eaux du lac, qui s'effectue chaque année, est toujours total et permet, par conséquent, une bonne oxygénation des fonds (Balvay, 1967-1968a et 1967-1968b; 1986). Les premières mesures d'oxygène dissous réalisées dans le lac en 1966 ont montré que les concentrations de ce paramètre sont restées, tout au long de l'année, supérieures à 7 mg/l entre 0 et -50 m (Balvay, 1967-1968a et 1967-1968b). Toutefois, des prospections dans la zone profonde, au delà de -40 m, ainsi que dans la partie sud du lac, s'avèrent indispensables à une meilleure vue d'ensemble de l'état actuel des peuplements de mollusques de cet écosystème.

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BIBLIOGRAPHIE

BALVAY, G. 1967-1968a. Aperçu sur l'état des trois grands lacs savoyards. *Revue de l'Institut Pasteur de Lyon* 1 (3): 431-441.

BALVAY, G. 1967-1968b. Le lac d'Annecy aperçu sur quelques données physico-chimiques en 1966. *Revue de l'Institut Pasteur de Lyon* 1 (3): 443-449.

BALVAY, G. 1986. La situation actuelle du lac d'Annecy. *In*: La société des amis du vieil Annecy (ed). Le Lac d'Annecy. *Annesci* 26: 177-194.

BOUSCASSE, R. 1979. Dégénérescence des Roselières du lac d'Annecy (Haute-Savoie). *Rapport INRA-ISARA*, 33 pp.

FAVRE, J. 1927. Les mollusques post-glaciaires et actuels du bassin de Genève. *Mémoire de la Société de Physique et d'Histoire naturelle de Genève* 40 (3): 171-434.

FAVRE, J. 1940. La faune malacologique post-glaciaire et actuelle du Lac du Bourget. *Annales de l'Ecole nationale des Eaux et Forêts* 7 (2): 295-444.

FAVRE, J. 1941. Les *Pisidium* du canton de Neuchâtel. *Société Neuchâteloise des Sciences Naturelles* 66: 57-112.

FOREL, F. A. 1884. Etudes zoologiques dans les lacs de Savoie. 1-2. Hydracariens, mollusques et plancton du lac d'Annecy. *Revue Savoisienne* 1: 1-2.

JUGET, J. 1958. Recherches sur la faune de fond du Léman et du lac d'Annecy. *Annales de la Station centrale d'Hydrobiologie appliquée* 7: 7-96.

HOUGHTON, J. T., MEIRA FILHO, L. G., CALLENDER, B. A., HARRIS, N., KATTENBERG, A. & MASKELL, K., 1996. Climate change 1995. The IPCC report. *Cambridge University Press*, 572 pp.

HUBAULT, E. 1947. Etude thermique, chimique et biologique des eaux des lacs de l'Est de la France. *Annales de l'Ecole nationale des Eaux et Forêts* 10 (2): 115-260.

KUIPER, J. G. J. 1966. La distribution des espèces du genre *Pisidium* C. PF. en France. *Journal de Conchyliologie* 105: 181-215.

LE ROUX, M. 1907-1908. Recherches biologiques sur le lac d'Annecy. *Annales de Biologie lacustre* 2: 220-387.

MEIER-BROOK, C. 1975. Der ökologische Indikatorwert mitteleuropäischer *Pisidium* Arten (Mollusca, Eulammellibranchiata). *Eiszeitalter und Gegenwart* 26: 190-195.

MOUTHON, J. 1981. Typologie des Mollusques des eaux courantes. Organisation biotypologique et groupements socioécologiques. *Annales de Limnologie* 17 (2): 143-162.

MOUTHON, J. 1990. Importance des conditions climatiques dans la différenciation des peuplements malacologiques des lacs européens. *Archiv für Hydrobiologie* 118 (3) : 353-370.

MOUTHON, J. 1992a. Snails and bivalves populations analysed in relation to physico-chemical quality of lakes in Eastern France. I – General criteria for population analyses. *Hydrobiologia* 245: 147-156.

MOUTHON, J. 1992b. Peuplements malacologiques lacustres en realation avec la physico-chimie de l'eau et des sédiments. II – Les espèces. *Annales de Limnologie* 28: 109-119.

MOUTHON, J. 1993. Un indice biologique lacustre basé sur l'examen des peuplements de mollusques. *Bulletin Français de Pêche et de Pisciculture* 331: 397-406.

MOUTHON, J. 1996. Molluscs and biodegradable pollution in rivers: proposal for a scale of sensitivity of species. *Hydrobiologia* 317: 221-229.

MOUTHON, J. 1999. Longitudinal organisation of the mollusc species in a theoretical French river. *Hydrobiologia* 390: 117-128.

MOUTHON, J. & KUIPER, J. G. J. 1987. Inventaire des Sphaeriidae de France. *Secrétariat de la Faune et de la Flore et Muséum national d'Histoire naturelle* (éds), Paris. Fasc. 41: 1- 60.

MOUTHON, J. & DUBOIS, J.-P. 2001. Les peuplements de la zone littorale du lac d'Annecy (Savoie, France). *Annales de Limnologie* 37 (4): 267-276.

WALTER, J.E. & KUIPER, J. G. J. 1978. Über Verbreitung und Ökologie von Sphaeriiden im Zürichsee (Mollusca: Eulamellibranchiata). *Schweizerische Zeitschrift für Hydrologie* 40 (1): 60-86.

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Hypostomus fonchii sp. n. (Siluriformes: Loricariidae) from Peru, a key species suggesting the synonymy of *Cochliodon* with *Hypostomus*

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***Hypostomus fonchii* sp. n. (Siluriformes: Loricariidae) from Peru, a key species suggesting the synonymy of *Cochliodon* with *Hypostomus*. -** *Hypostomus fonchii* sp. n. is described. Diagnostic characters are the unicuspid premaxillary and dentary teeth, present in subadults as well as in adults, and the elongated and broad tooth crown. Because these tooth characters are intermediate between *Hypostomus* and *Cochliodon*, and because dentition traits are the only characters diagnosing *Cochliodon*, the discovery of *H. fonchii* provides evidences for questioning the generic status of *Cochliodon*. We conclude that *Cochliodon* is a subjective junior synonym of *Hypostomus*. This work is the first part of our joint investigations on *Hypostomus* based on both morphological and molecular characters.

Key-words: Catfishes - *Hypostomus* - *Cochliodon* - *Hypostomus fonchii* - new species - systematics - teeth.

INTRODUCTION

The genus *Hypostomus* Lacépède, 1803, represents one of the most diverse Neotropical catfish groups, with about 120 species. The monophyly of this genus has been often questioned and no uniquely derived shared characters have been found (Schaefer, 1986, 1987). The reason lies in the complex and entangled morphological traits and in the substantial intraspecific variability found in *Hypostomus* and closely related genera. In *Hypostomus* systematics, as for most loricariids genera, distinguishing between reliable and misleading morphological characters remains the most problematic task.

During a recent field trip in the Cordillera Azul, Peru, Patrick de Rham, correspondent member of the Museum of Natural History of Geneva, collected three specimens of a remarkable and undescribed hypostomine species. The collecting localities are situated in the middle portion of the Río Ucayali basin (Fig. 1). This species

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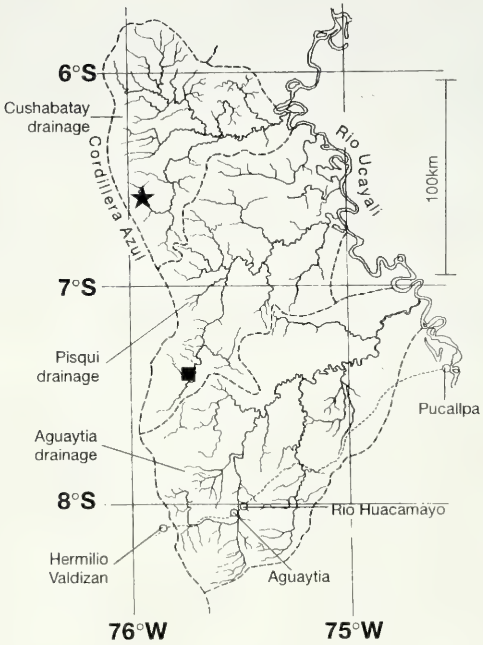


FIG. 1

Map of Cordillera Azul, Ucayali, Peru. Collection localities of *Hypostomus fonchii* sp. n.: ★ = station 1 (type-locality), ■ = stations 2 & 3.

displays large unicuspid teeth in the subadult as well as in adult, a feature that has never been observed in the genus. Among genera close to *Hypostomus*, only adult *Cochliodon* Kner, 1874 possesses such a character (Schultz, 1944; Lilyestrom, 1984). Indeed, the genus *Cochliodon* is presently distinguished from *Hypostomus* only on the basis of its peculiar dentition (Isbrücker, 1981; Armbruster, 1997).

In this first part of our joint study, we describe *Hypostomus fonchii* sp. n. and discuss the validity of the characters diagnosing *Cochliodon*. In the second part (Montoya-Burgos *et al.*, 2002), we propose a molecular phylogeny of *Hypostomus* and related genera which confirms the results presented here and provides furthermore a new view on *Hypostomus* systematics.

MATERIAL AND METHODS

Specimens examined in this study belong to the fish collections of the following institutions: MAPA: Museu Anchieta, Porto Alegre; MHNG: Muséum d'histoire naturelle, Genève; MNRJ: Museu Nacional, Rio de Janeiro; MUSM: Museo de Historia Natural de la Universidad Nacional Mayor de San Marcos, Lima; MZUSP: Museu de Zoologia, Universidade de São Paulo; NRM: Naturhistoriska Riksmuseet, Stockholm. The measurements and counts follow Boeseman (1968) and Weber (1985).

DESCRIPTION

Hypostomus fonchii sp. n. Figs 2, 3; Tables 1, 2

HOLOTYPE

MHNG 2613.66, 141.3 mm of SL (specimen and tissue sample). Peru: Ucayali: Quebrada John, lower part, near mouth in the Río Pauya, in shallow water with emerging rocks, 06° 36' 7.0"S/75°56'26.3''W (GPS), alt. 360 m, Río Cushabatay drainage, Río Ucayali basin (Station 1); 30. Aug. 2000; leg. Patrick de Rham (field n° CA12).

Description of Station 1: Water transparent, substrate composed of large rocks on fine sand and clay. No aquatic vegetation. Water characteristics: depth: 20-200 cm, temperature 25°C, conductivity 160 µs/cm, pH 7.8, total hardness 6.5°. Fishes were collected by hand and snorkeling.

PARATYPES

MUSM 18791 (1 ex.), 56.3 mm of SL (tissue sample MHNG 2613.67). Peru: Ucayali: Quebradita near the camp "Alto Pisqui Llanura", about 100 m East from the point 08°24' 16"S/75°42'05.5"W (GPS), alt. about 200m, Río Pisqui drainage, Río Ucayali basin (Station 2); 30.Aug.- 05. Sep. 2000; leg. Patrick de Rham (field n° CA37).

Description of Station 2: Water transparent, substrate composed of sand, clay, leaves and dead woods. No aquatic vegetation. Water characteristics: depth: 10-30 cm., temperature 26°C. Fishes were collected with landing nets and fish pots.

MHNG 2613.68 (1 ex.), 50.4 mm of SL (specimen and tissue sample). Peru: Ucayali: unnamed quebrada, in very shallow water, a few hundred meters southeast from the point 08°24'16"S/75°42'05.5"W (GPS), alt. 550-700m, Río Pisqui drainage, Río Ucayali basin (Station 3); 02. Sep. 2000; leg. Patrick de Rham (field n° CA30).

Description of Station 3: Water transparent, substrate composed of sand, clay and shingle. No aquatic vegetation. Water characteristics: depth: 10-30 cm, temperature 26°C. Fishes were collected with hand nets.

OTHER SPECIMENS EXAMINED

The following lots may represent the same species, but are excluded from the type series, because these specimens bear clear morphometric differences (see below).

MHNG 2958.91 (2 ex., 72.7 - 72.9 mm of SL). Peru: Ucayali: Coronel Portillo: Río Huacamayo, near the road Pucallpa - Tingo Maria (Carretera Frederico Basadre), 8 km north-east from Aguaytia; Río Aguaytia drainage, Río Ucayali basin; 06. Oct. 1984; leg. Hernan Ortega and Patrick de Rham.

MHNG 2395.61 (1 ex., 124.7 mm of SL). Same locality; 29. Jul. 1986; leg. Hernan Ortega.

DERIVATIO NOMINIS

This species is named in the memory of Fonchii Chang, who disappeared tragically in 1999, during a field trip in Peru; noun in apposition to the generic name.

DIAGNOSIS

Hypostomus fonchii sp. n. is distinguished from all other *Hypostomus* in having unicuspid premaxillary and dentary teeth, in subadult as well as in adult specimens, instead of teeth with an outer cusp. The crown of the tooth (Fig. 2, e) is elongated and broad (2.24 times width in its length in holotype).

DESCRIPTION

Morphology

Morphometric and meristic data are summarized in Tables 1 and 2.

TABLE 1. Morphometric data of the type specimens of *Hypostomus fonchii* sp. n.

Characters	measurements (mm)				ratio				
	holotype	paratype 1	paratype 2	n	in	holotype	paratype 1	paratype 2	mean
standard length (A)	141.3	56.3	50.4	3					
axial length (B)	166.5	69.2	63.4	3					
total length (C)	191	81.5	72.1	3					
predorsal length (D)	52.1	24	21.7	3	A	2.71	2.35	2.32	2.46
head length (E)	42.3	21.4	19.2	3	A	3.34	2.63	2.63	2.87
cleithral width (F)	40.1	18.4	16.5	3	E	1.05	1.16	1.16	1.13
head depth (G)	27	12.3	11.1	3	E	1.57	1.74	1.73	1.68
snout length (H)	28	12.2	10.5	3	E	1.51	1.75	1.83	1.7
orbital diameter (I)	7.1	4.8	4.3	3	E	5.96	4.46	4.47	4.96
interorbital width (J)	19.6	7.7	6.8	3	E	2.16	2.78	2.82	2.59
dorsal fin spine length (K)	40.5	18.5	16.7	3	A	3.49	3.04	3.02	3.18
dorsal fin spine length (K)				3	D	1.29	1.3	1.3	1.29
dorsal fin base length (L)	39.8	15	14.1	3	A	3.55	3.75	3.57	3.63
interdorsal length (M)	25.5	9	8.1	3	A	5.54	6.26	6.22	6.01
thoracic length (N)	33.9	13.3	12.6	3	A	4.17	4.23	4.00	4.13
pectoral fin spine length (O)	38.2	14.6	12.8	3	A	3.70	3.86	3.94	3.83
abdominal length (P)	29.9	11.5	12	3	A	4.73	4.90	4.20	4.61
ventral fin spine length (Q)	34.5	14.3	10.4	3	A	4.1	3.94	4.85	4.29
caudal peduncle length (R)	49.1	17.3	15.8	3	A	2.88	3.25	3.19	3.11
caudal peduncle depth (S)	14.9	6.1	5.5	3	A	9.48	9.23	9.16	9.29
caudal peduncle depth (S)				3	M	1.71	1.48	1.47	1.55
caudal peduncle depth (S)				3	R	3.3	2.84	2.87	3
adipose fin length (T)	7.8	4.4	3.9	3					
upper caudal ray length (U)	50.1	24.3		2					
lower caudal ray length (V)	47.5	23.9	20.7	3					
rictal barbel length	3.3	2.2	1.8	3					
right mandib. ramus length (RM)	7.3	4	3.5	3	J	2.68	1.93	1.94	2.18

TABLE 2. Meristic data of the type specimens of *Hypostomus fonchii* sp. n.

characters	counts			
	holotype	paratype 1	paratype 2	mean
series of lateral scutes	28	28	28	28
plates bordering supraoccipital	1	1	1	1
predorsal scutes	3	3	3	3
dorsal base scutes	8	9	9	8.7
dorsal to adipose fin scutes	7	7	6	6.7
adipose to caudal fin scutes	9	8	9	8.7
anal to caudal fin scutes	15	15	15	15
teeth on left premaxilla	19	18	20	19
teeth on right premaxilla	19	21	18	19.3
teeth on left dentary	22	18	22	20.5
teeth on right dentary	20	25	21	22

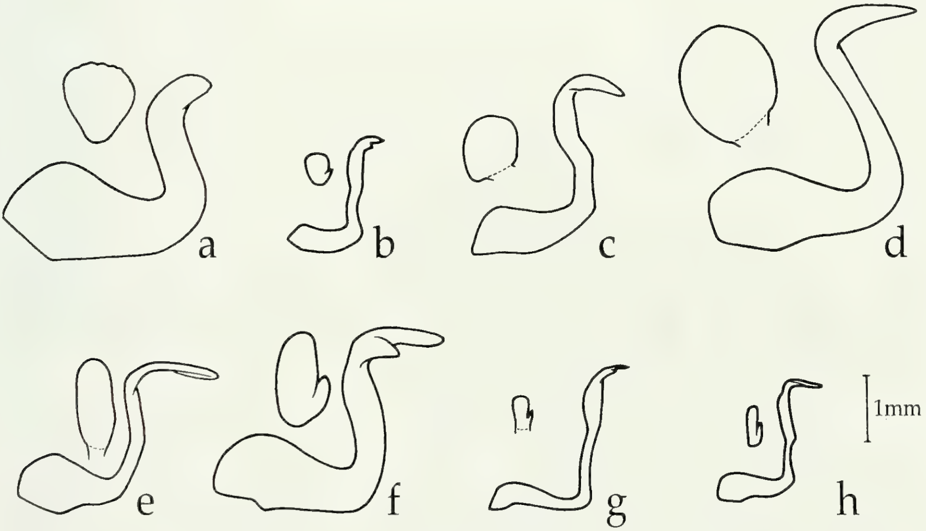
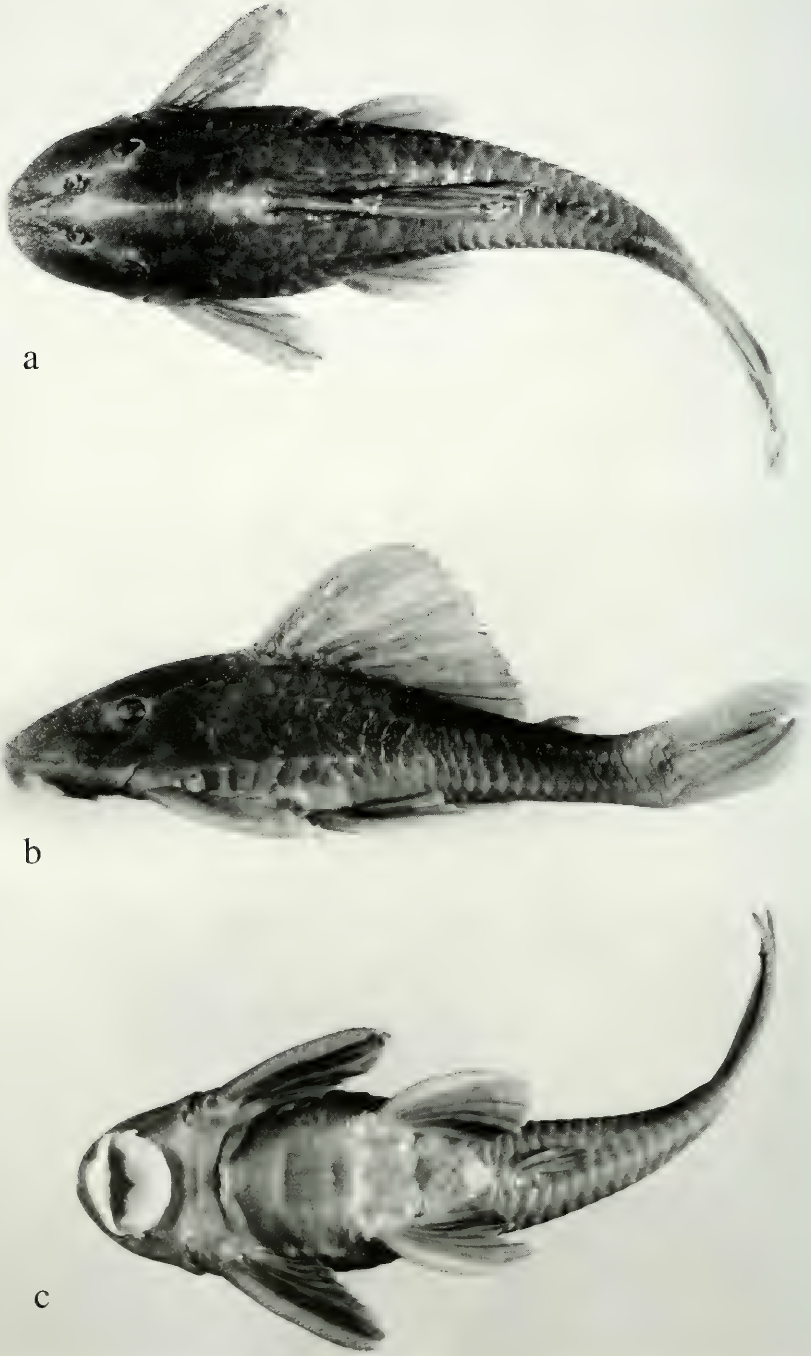


FIG. 2

Profile view of teeth and dorsal view of dental crown (material examined see also Appendix): a, *Cochliodon cochliodon* (Kner, 1854) (LS = 227.8 mm); b, *Cochliodon* sp. 2 (LS = 127 mm) from rio Xingu; c, *Cochliodon* sp. 2 (LS = 157.6 mm) from rio Xingu; d, *Panaque* sp. (LS = 217 mm) from rio Tocantins drainage; e, *Hypostomus fonchii* sp. n. (LS = 141.3 mm); f, *Hypostomus roseopunctatus* Reis *et al.*, 1990 (LS = 133 mm); g, *Hypostomus boulengeri* (Eigenmann & Kennedy, 1903) (LS = 162.4 mm); h, *Hypostomus albopunctatus* (Regan, 1908) (LS = 166.6 mm).

Adult (holotype, Fig. 3, a-c). Head dorsally covered with odontods except a small naked area on snout tip, roughly triangular (upside down), as large as nostril. Dorsal margin of orbit very slightly elevated, continuing in smoother ridge on posttemporal and first contiguous plate. Very low ridge on supraoccipital, becoming wider and somewhat more tabular on predorsal plates. One plate bordering posterior margin of supraoccipital. Body deep, dorsal profile gradually descending from dorsal


a
b
c

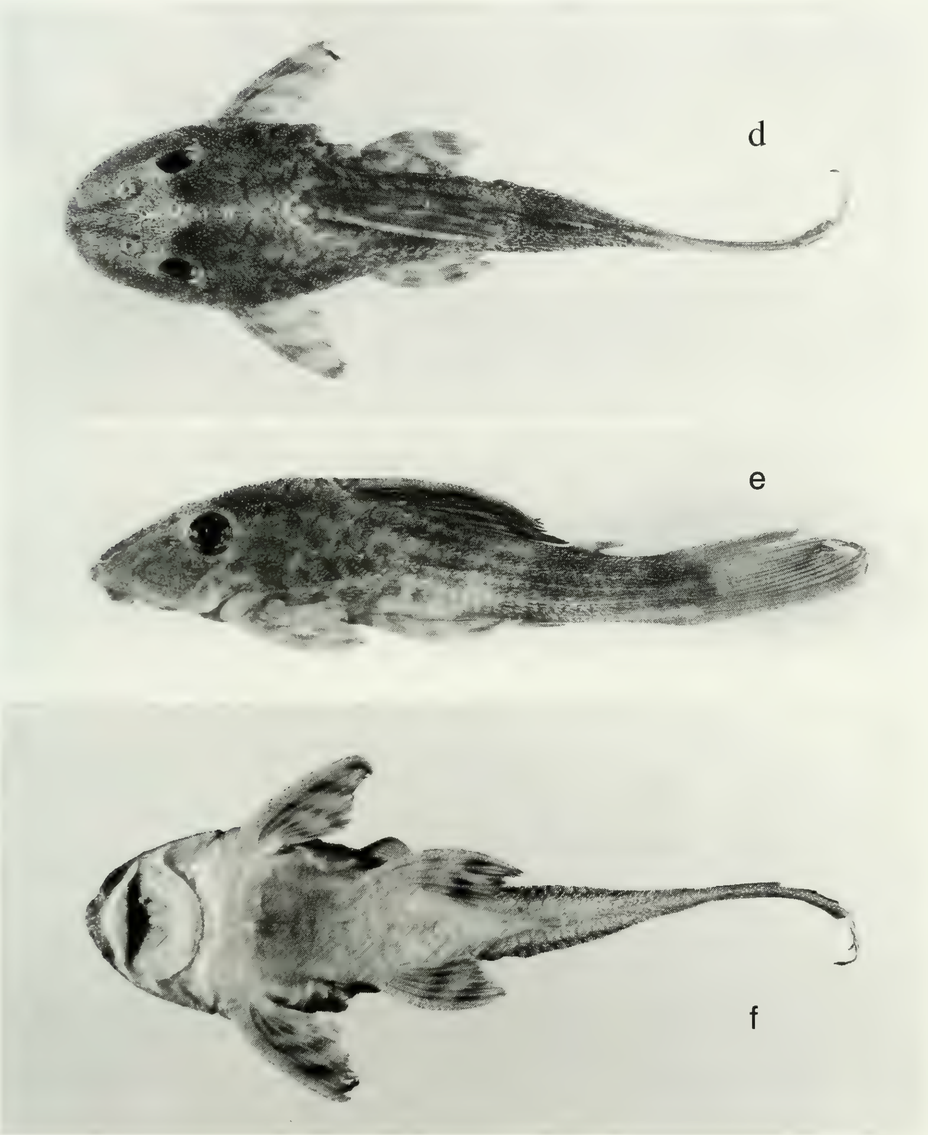


FIG. 3

Adult and juvenile *Hypostomus fonchii* sp. n. Holotype: (a) dorsal, (b) lateral, (c) ventral views; SL = 141.4 mm (MHNG 2613.66). Paratype: (d) dorsal, (e) lateral, (f) ventral views; SL = 56.3 mm (MUSM 18791).

spine origin to four plates before end of caudal peduncle. Caudal peduncle roughly ovate in cross-section; dorsal plates, from middle of dorsal-fin base to end of base of adipose fin, flat in their dorsal portion. Outer face of upper lip covered with small platelets; maxillary barbels short. Teeth moderately large, crown elongated without lateral cusp (Fig. 2, e). Body completely covered with five rows of smooth plates with very slight angle in medial portion, forming four longitudinal nearly unconspicuous ridges. Abdomen and ventral surface of head completely covered with minute platelets. Distal quarter of pectoral-fin spine dorsally covered with progessively larger proeminent odontods, larger ones stronger hooked. Dorsal fin, when layed down, reaches half plate far from adipose fin. Adipose fin medium sized and slightly curved. Caudal-fin margin strongly concave; medium sized outer rays.

Subadult (Fig. 3, d-f). Differs from adult in having only small lateral areas of outer face of upper lip covered with small platelets. Platelets of ventral face (head and abdomen) much less numerous and spread on whole surface, isolated from one another. Distal part of pectoral-fin spine without elongated odontods.

Color pattern (in alcohol)

Adult. Ground color of dorsal surface gray-brown becoming lighter on caudal peduncle; dorsal surface of head with lighter areas between eyes, along middle of snout, and between eye and nostril. Body covered with very small dots becoming larger posteriorly, from first scutes to end of dorsal fin. Posteriorly, dots turn into hazy vertical marks. Color of outer face of upper lip slightly lighter than snout except in a small distal margin, cream colored, as inner part of lips. Dorsal fin mottled, as membranes and branched rays of other fins. Pectoral and ventral spines lighter with few dots. Ventrally, ground color lighter, with scarce small dots close to latero-ventral plates; posteriorly, larger vague dots in whole area between ventral and anal fins. Anal fin with vague transversal bars.

Subadult. Differs from adult in having dorsally larger spots, three conspicuous transversal bars in dorsal, pectoral, and ventral fins; ventrally, plain paler ting.

The population from Río Huacamayo differs in having a longer dorsal fin spine (D/K=1.06-1.13 versus 1.29-1.30) a higher caudal peduncle (R/S=2.64-2.80 versus 2.84-3.30), a larger mandibular ramus (J/RM=1.80-1.92 versus 1.93-2.68) with more numerous teeth (26-44 versus 18-25), and by the presence of spots on the dorsal surface of the head and on the dorsal fin.

DISTRIBUTION

Hypostomus fonchii sp. n. is only known from the Río Cushabatay, Río Pisqui and Río Aguaytia drainage. These rivers are located in the area of the Cordillera Azul, Peru, and are West side tributaries of the middle Río Ucayali (Fig. 1).

DISCUSSION

Like most loricariids, *Hypostomus* species possess teeth bearing a lateral cusp (Gosline, 1947). In *Hypostomus*, bicuspid teeth are present in subadult and adult stages (Weber, 1986). Contrasting with this common feature, the genus *Cochliodon* was established on the basis of its particular dentition: teeth are unicuspided, spoon-shaped, massive and few in number (Kner, 1854). Later on, Eigenmann (1922) described the genus *Cheiridodus*, separating it from *Cochliodon* by the presence of a "small lobe on the outer edge of the base of each tooth" (referred here as bicuspid tooth). Eigenmann's description was based on two young specimens of current *Cochliodon hondae* (Regan, 1912) (70 and 88 mm axial length). In describing *Cochliodon pospisili* (presently a synonym of *C. hondae*), Schultz (1944) reported that young specimens up to 60 mm standard length possess teeth with such a lobe (bicuspid tooth), however he noticed that these teeth are gradually replaced by unicuspid teeth in adults. Based on these observations, Schultz pointed out the necessity of revising the relationship between *Cheiridodus* and *Cochliodon*. Dahl (1971, and reference therein) recognized *Cheiridodus* as a synonym of *Cochliodon*, stressing the fact that the description of *Cheiridodus* is based on immature specimens still bearing bicuspid tooth. The ontogenic modification of teeth in *C. hondae* was confirmed by Lilyestrom (1984) who observed that only scarce specimens of more then 100 mm standard length still bear bicuspid teeth. In our own observations of *Cochliodon cochliodon* (Kner, 1854), *Cochliodon oculeus* (Fowler, 1943), and *Cochliodon* sp. 1, the teeth replacement occurs in specimens with a comparable body size range (Fig. 4) as the values cited above. The fact that *Cochliodon* species undergo a dentition modification during their growth, gradually replacing their bicuspid by unicuspid teeth when reaching adult size, is thus well documented.

Due to its peculiar dentition, *Hypostomus fonchii* sp. n. can be referred neither to *Hypostomus* nor to *Cochliodon*. The tooth of *H. fonchii*, which displays a single main cusp and which is identical in adults as well as in subadults (Fig. 2, e; Fig. 4), is a unique character among these genera. Nevertheless, the elongated and thin stem, the thin root, and the elongated main cusp of *H. fonchii* tooth are reminiscent of those found in the *Hypostomus regani* group (Fig. 2, h), as defined in Muller & Weber (1992). On the other hand, the absence of the lateral cusp is generally considered as a synapomorphy of *Cochliodon*, when referring to adult specimens. The fact that *H. fonchii* presents somewhat intermediate teeth compared to *Hypostomus* and *Cochliodon* rises the question of whether this new species has to be placed in a new genus or if the validity of tooth morphology as generic diagnostic character is to be reconsidered. Indeed, placing *H. fonchii* either in *Hypostomus* or in *Cochliodon* would challenge, at least in part, the validity of the tooth shape as diagnostic character for *Cochliodon*. Placing *H. fonchii* within *Hypostomus* invalidates the adult unicuspid-tooth criterion uniting *Cochliodon* species. Placing *H. fonchii* within *Cochliodon* invalidates in turn the massive, few in number and spoon-shaped tooth criteria uniting *Cochliodon* species. If *H. fonchii* is to be placed in a new genus, the latter will share common features with both *Hypostomus* and *Cochliodon*, and will invalidate as well the adult unicuspid-tooth criterion uniting *Cochliodon*. In all three cases, the diagnostic characters supporting *Cochliodon* are questionable to a point at which the generic status of *Cochliodon* should be reconsidered. Because none of the alternatives is fully convincing, the most reasonable way to solve this taxonomic question is to consider *Cochliodon* as a synonym of *Hypostomus*.

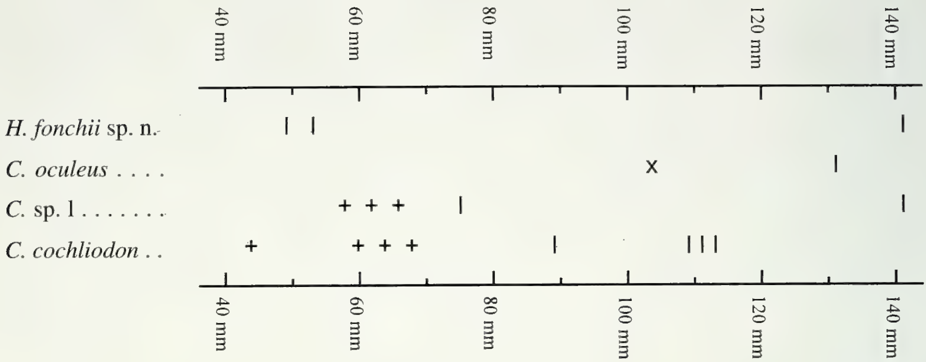


FIG. 4

Tooth morphology as a function of standard length in *Hypostomus fonchii* sp. n. and *Cochliodon* spp. (material examined see Appendix): (+) premaxillary and dentary teeth with lateral cuspid; (l) absence of lateral cuspid; (x) mixture of teeth with and without lateral cuspid.

The tooth survey reported in this study (Fig. 2) provides additional arguments for questioning the generic status of *Cochliodon* based on tooth morphology. Every state of root width, stem length and crown size can be found among *Cochliodon* and *Hypostomus* species. Setting apart the number of cusps of the crown, the tooth of *H. roseopunctatus* Reis, Weber & Malabarba, 1990 (Fig. 2, f) shows more affinities to *C. cochliodon* tooth (Fig. 2, a) than to the one of *H. boulengeri* Eigenmann & Kennedy, 1903 (Fig. 2, g), whereas *H. boulengeri* tooth is more similar to the one of the undescribed *Cochliodon* sp. 2 (Fig. 2, b-c). According to Isbrücker (1981), *Cochliodon* sp. 2 can be attributed to the *Cochliodon* genus without doubt due to its bicuspid subadult tooth and its unicuspid spoon-shaped adult tooth. Nevertheless, the slenderness of the tooth stem and root, and the small size of the crown of *Cochliodon* sp. 2 are reminiscent of *Hypostomus* teeth. As to *H. fonchii*, its teeth (Fig. 2, e) is more *Hypostomus*-like (for example *Hypostomus albopuctatus* Regan, 1908; Fig 2, h), but the unicuspid criterion brings it closer to *Cochliodon*. The evident outcome of this comparative analysis is that tooth morphology can no longer be used for diagnosing *Cochliodon*.

Lastly, the tooth of *Panaque* sp. (Fig. 2, d) shows strong similarities with *Cochliodon*. Schaefer & Stewart (1993), while describing *Panaque maccus*, exposed in details various teeth shapes, from slender comb-shaped and bicuspid, to spoon-shaped and unicuspid with an intermediate state, more spoon-shaped and bicuspid. They pointed out an allometric association between tooth morphology and standard length, as for *Cochliodon*. It is a striking example of tooth polymorphism and possible convergences among loricariids.

In addition to the tooth related arguments presented here for considering *Cochliodon* as a synonym of *Hypostomus*, which are of prime importance because they concern the diagnostic characters, two other independent phylogenetic works support our conclusions. The first work, based on osteological characters, suggests that

Cochliodon, together with other closely related genera, emerge from *Hypostomus* and, therefore, are *Hypostomus* synonyms (Armbruster, 1997). The second work, based on mitochondrial D-loop sequences and which is presented in this volume (Montoya-Burgos *et al.,* 2002), suggests that *Cochliodon*, and only this genus, emerges from *Hypostomus*. Moreover, the mitochondrial sequence analyzes indicate that *H. fonchii*, in turn, emerges within *Cochliodon*.

With these new elements at hand, we can propose a reconstruction of the evolution of *H. fonchii* dentition. According to the scenario where *Cochliodon* emerges from *Hypostomus* and where *H. fonchii* emerges from *Cochliodon*, the tooth of *H. fonchii* represents the ultimate state in a three step series starting from the plesiomorphic bicuspid-tooth state (*Hypostomus*), followed by bicuspid tooth present in young specimen and gradually replaced by unicuspid tooth in adult (*Cochliodon*), and ending in the young and adult unicuspid-tooth state (*H. fonchii*). This same scenario, however, implies that the elongated cusp present in *H. fonchii* is a homoplastic character because similar main cusp shapes are often found in other *Hypostomus* species, whereas all *Cochliodon* described so far show a spoon-shaped cusp. The possibility that the shape of the main cusp can be homoplastic within *Cochliodon* plus *Hypostomus* is supported by the important variability of this character among species, and even within species, as reported by Weber (1986) and Muller & Weber (1992). Nevertheless, these authors found that the combination of tooth characteristics with mouth morphology can be used for defining species or groups of species.

CONCLUSIONS

Because only dentition characters diagnose *Cochliodon*, separating it from *Hypostomus*, the discovery of *H. fonchii* sp. n. and the analysis of its peculiar teeth enable us to state that *Cochliodon* has to be considered as a subjective junior synonym of *Hypostomus*. This proposal is congruent with two independent phylogenetic works, one based on osteology, the other based on molecular data. Moreover, this new species provides a critical example stressing that great care should be taken when using tooth morphology as a diagnostic generic criterion within the family Loricariidae.

The following nomenclature modifications derive from the synonymization of *Cochliodon* with *Hypostomus*.

Hypostomus Lacepède, 1803

Hypostomus Lacepède, 1803: 145. Type species: *Acipenser plecostomus* Linnaeus, 1754.

Cochliodon Heckel *in* Kner, 1854: 265. **Syn. n.** Type species: *Hypostomus cochliodon* Kner, 1854.

Cheiridodus Eigenmann, 1922: 70. Type species: *Plecostomus hondae* Regan, 1912.

The following species move to new combinations (comb. n.) or their original combinations are revalidated (comb. reval.):

Hypostomus cochliodon Kner, 1874 comb. reval.
Plecostomus hondae Regan, 1912 = *Hypostomus hondae* (Regan, 1912) comb. n.
    Synonym: *Cochliodon pospisili* Schultz, 1944 = *Hypostomus pospisili* (Schultz, 1944) comb. n.
Rhinelepis levis Pearson, 1924 = *Hypostomus levis* (Pearson, 1924) comb. n.
Panaque oculeus Fowler, 1943 = *Hypostomus oculeus* (Fowler, 1943) comb. n.
Cochliodon plecostomoides Eigenmann, 1922 = *Hypostomus plecostomoides* (Eigenmann, 1922) comb. n.
Cochliodon pyrineusi Miranda Ribeiro, 1920 = *Hypostomus pyrineusi* (Miranda Ribeiro, 1920) comb. n.
Cochliodon taphorni Lilyestrom, 1984 = *Hypostomus taphorni* (Lilyestrom, 1984) comb. n.

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We dedicate this work to Fonchii Chang, who devoted her life to the advancement of ichthyology in Peru, her country.

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REFERENCES

ARMBRUSTER, J.W. 1997. Phylogenetic Relationships of the Sucker-Mouth Armored Catfishes (Loricariidae) with Particular Emphasis on the Ancistrinae, Hypostominae and Neoplecostominae. *Unpublished Ph.D. Dissertation, University of Illinois, Urbana,* 405 pp., 134 figs, 2 appendix.

BOESEMAN, M. 1968. The genus *Hypostomus* Lacépède, 1803, and its Surinam representatives (Siluriformes, Loricariidae). *Zoologische Verhandelingen, Rijksmuseum van Naturlijke Historie te Leiden* 99: 1-89, 18 pls, 20 tabs.

DAHL, G. 1971. Los Peces del norte de Colombia. Bogota, *INDERENA*.

EIGENMANN, C. H. 1922. The fishes of western South America, part 1. The fresh-water fishes of Northwestern South America, including Colombia, Panama, and the Pacific slopes of Ecuador and Peru, together with an appendix upon the fishes of the Río Meta in Colombia. *Memoirs of the Carnegie Museum, Pittsburg* 9(1): 1-346, 38 pls.

GOSLINE, W. A. 1947. Contribution to the classification of the loricariid catfishes. *Archivos do Museu nacional, Rio de Janeiro* 41: 79-134, 9 pls.

ISBRÜCKER, I. J. H. 1981. A treatise of the Loricariidae Bonaparte, 1831, a family of South American mailed catfishes, with emphasis on the subfamily Loricariinae (Pisces, Siluriformes). *Unpublished Ph.D.Dissertation, Université de Nancy I, Nancy,* 224 pp., 52 pls.

KNER, R. 1854. Die Hypostomiden. Zweite Hauptgruppe der Familie der Panzerfische (Loricata vel Goniodontes). *Denkschriften der Akademie der Wissenschaften, Wien, mathematische-naturwissenschaftlische Klasse* 7: 251-286, 5 pls.

LILYESTROM, C. G. 1984. Consideraciones sobre la taxonomia de las especies del genero *Cochliodon* Heckel en Venezuela (Pisces, Loricariidae). *Revista UNELLEZ de Ciencia y Tecnologia, Serie Produccion agricola, Venezuela* 2(2): 41-53.

MONTOYA-BURGOS, J. I., WEBER, C. & LE BAIL, P.-Y. 2002. Phylogenetics relationships within *Hypostomus* (Siluriformes: Loricariidae) and related genera based on mitochondrial D-loop sequences. *Revue suisse de Zoologie* 109 (2): 369-382.

MULLER, S. & WEBER, C. 1992. Les dents des sous-familles Hypostominae et Ancistrinae (Pisces, Siluriformes, Loricariidae) et leur valeur taxonomique. *Revue suisse de Zoologie* 99(4): 747 -754.

SCHAEFER, S. A. 1986. Historical biology of the loricariid catfishes: Phylogenetics and functional morphology. *Unpublished Ph.D Dissertation, University of Chicago, Chicago*, 198 pp., 46 figs.

SCHAEFER, S. A. 1987. Osteology of *Hypostomus plecostomus* (Linnaeus), with a phylogenetic analysis of the loricariid subfamilies (Pisces: Siluroidei). *Contributions in Science, Los Angeles* 394: iii-iv, 1-31.

SCHAEFER, S. A. & STEWART, D. J. 1993. Systematics of the *Panaque dentex* species group (Siluriformes: Loricariidae), wood-eating armored catfishes from tropical South America. *Ichthyological Exploration of Freshwaters* 4(4): 309-342.

SCHULTZ, L. P. 1944. The catfishes of Venezuela, with description of thirty-eight new forms. *Proceedings of the United States National Museum, Washington* 94: 173-338.

WEBER, C. 1985. *Hypostomus dlouhyi*, nouvelle espèce de poisson-chat cuirassé du Paraguay (Pisces, Siluriformes, Loricariidae). *Revue suisse de Zoologie* 94(4): 955-968.

WEBER, C. 1986. Révision de *Hypostomus boulengeri* (Eigenmann and Kennedy) et deux espèces nouvelles de poissons-chats du Paraguay (Pisces, Siluriformes, Loricariidae). *Revue suisse de Zoologie* 93(4): 979-1007.

APPENDIX. Other material examined.

Hypostomus cochliodon Kner, 1854 (previously *Cochliodon cochliodon*)
MHNG 2527.38 (3 ex), 41.6 - 73.8 mm of SL. Paraguay: Concepción: Riacho La Paz 6 km North of Estancia Primavera, Río Paraguay basin; 19-20 Oct. 1991; leg. C. Dlouhy, S. Muller and C. Vaucher.
MHNG 2527.40 (4 ex), 60.8 - 122.7 mm of SL. Paraguay: Concepción: Arroyo Aegre, tributary of Riacho La Paz, 6 km southeast of Estancia Primavera, Río Paraguay basin; 16-19 Oct. 1991; leg. C. Dlouhy, S. Muller and C. Vaucher.
MHNG 2395.39 (1 ex), 90.2 mm of SL. Paraguay: Concepción: Arroyo Alegre, tributary of Riacho La Paz , 6 km southeast of Estancia Primavera, Río Paraguay basin; 20 Oct. 1985; leg. C. Dlouhy, A. de Chambrier and C. Vaucher.
MHNG 2236.92 (2 ex), 111.3 - 111.8 mm of SL. Paraguay: Concepción: Arroyo Tagatija-Guazu, tributary of the Río Napegue, ford on the road Paso Horqueta - Estancia Santa-Maria, Río Paraguay basin; 20 Oct. 1985; leg. C. Dlouhy, V Mahnert and C. Vaucher.

Hypostomus oculeus (Fowler, 1943) (previously *Cochliodon oculeus*)
NRM 27052 (1ex.), 104.3 mm of SL. Colombia: Caqueta: Quebrada Montanita, alt. 400 m.; 26 Feb. 1993; leg. A. Stalsberg.
MHNG not registered. Ecuador: Napo: Río Aguarico, Lago Agrio, Río Napo basin; Summer 1985; leg. U. Werner.

Hypostomus sp. 1 (undescribed, previously *Cochliodon* sp. 1)
MHNG 2395.38 (4 ex.) 58.1 – 100.7 mm of SL. Paraguay: : Concepción: Arroyo Alegre, tributary of Riacho La Paz , 6 km southeast of Estancia Primavera, Río Paraguay basin; 5 Nov. 1987; leg. C. Dlouhy, A. de Chambrier and C. Vaucher.
MHNG 2395.39 (1 ex.) 147.1 mm of SL. Paraguay: Concepción: Arroyo Alegre, tributary of Riacho La Paz , 6 km southeast of Estancia Primavera, Río Paraguay basin; 03 Nov. 1987; leg. C. Dlouhy, A. de Chambrier and C. Vaucher.

MHNG 2527.40 (2 ex.) 65.3 – 73.7 mm of SL. Paraguay: Concepción: Arroyo Alegre, tributary of Riacho La Paz , 6 km southeast of Estancia Primavera, Río Paraguay basin; 19 Oct. 1991 leg. C. Dlouhy, S. Muller and C. Vaucher.
MHNG 2236. 93 (1 ex.) 141.4 mm de LS. Concepcion: Arroyo Azotey, affluent du Río Ypané, Río Paraguay basin, 0.3 km north of Cororo, route No 3; field n° PY 3343; 22 Oct. 1983; leg. C. Dlouhy and C. Weber.
MHNG 2236.96 (1 ex.) 193- 275 mm de LS. Paraguay: Cordillera: Río Piribebuy, tributary of Río Paraguay, 5 km North Emboscada Nueva; 6 Apr. 1985; leg F. Baud, C. Dlouhy and V. Mahnert.

Hypostomus sp. 2 (undescribed, previously *Cochliodon* sp. 2)
MZUSP 34284 (1 ex.), 127 mm of SL. Brazil: Pará: Rio Xingu at Belo Monte; Jul. 1983; leg. M. Goulding (Field number 29908).
MZUSP 34213 (1 ex.), 157,6 mm of SL. Brazil: Pará: Igarapé de Santo Antônio, Transamazônica road near Belo Monte, Rio Xingu drainage; 27 Oct. 1983; leg. M. Goulding (field n° 30494).

Hypostomus roseopunctatus Reis, Weber & Malabarba, 1990
MAPA 2315 (1 ex) 133 mm of SL. Brazil: Rio Grande do Sul: Río Uruguai at Uruguaiana, Rio Paraná basin; 14 May 1984; leg R. E. Reis.

Hypostomus albopunctatus (Regan, 1908)
BMNH 1907.7.6.15. Lectotype (1 ex.) 166.6 mm of SL. Brazil: São Paulo: Rio Piracicaba, Rio Paraná basin; leg. R. v. Ihering.

Hypostomus sp.
MNRJ 15371 (1 ex.), 158.2 mm of SL. Brazil: Goiás: Rio Maranhão, downstream of Cachoeira do Machadinho, Barro Alto / Niquelândia area, Rio Tocantins basin ; 13 Oct. 1996; leg E. P. Caramaschi, D. F. Moraes Jr and D. A. Halboth (field n°: BR 1134; PSM 06-3921).

Panaque sp.
MNRJ 15247 (1ex), 217 mm of SL. Brazil: Goiás: Niquelândia, Rio Maranhão, near mouth of Rio do Peixe, Rio Tocantins basin; 10 Oct. 1996; leg. E. Pellegrini Caramaschi, D. F. Moraes Jr and D. A. Halboth (field n°: BR 1081; PSM 06-3224).

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Phylogenetic relationships within *Hypostomus* (Siluriformes: Loricariidae) and related genera based on mitochondrial D-loop sequences

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Phylogenetic relationships within *Hypostomus* (Siluriformes: Loricariidae) and related genera based on mitochondrial D-loop sequences. - The complete D-loop sequence was obtained from 23 *Hypostomus* and 12 other species belonging to eight genera, from which seven are closely related to *Hypostomus*. The phylogenetic analysis of these sequences indicates that the genus *Hypostomus* is polyphyletic due to the exclusion of *H. emarginatus* and *H. squalinus* from the main *Hypostomus* clade. Moreover, this main *Hypostomus* clade includes all *Cochliodon* species examined here, indicating that *Cochliodon* can be considered as a subjective junior synonym of *Hypostomus*. This conclusion is also supported by the placement of *Hypostomus fonchii* within the *Cochliodon* clade, implying that the synapomorphic characters diagnosing *Cochliodon* are unfounded. Based on these results, a new vision of *Hypostomus* is proposed. Furthermore, our results confirm the previously reported polyphyly of Ancistrinae and question the monophyletic status of *Hemiancistrus*.

Key-words: Catfish - *Hypostomus* - *Cochliodon* - D-loop - molecular phylogeny.

INTRODUCTION

The Neotropical catfish family Loricariidae is traditionally subdivided into six subfamilies: Lithogeneinae, Neoplecostominae, Hypoptopomatinae, Loricariinae, Ancistrinae, and Hypostominae (Isbrücker, 1980; Schaefer, 1986). According to Isbrücker (1980), the subfamily Hypostominae comprises 16 genera characterized by inevertible bristle-like odontodes in the interopercular area, pectoral girdle not exposed, and with a relatively short, compressed or cylindrical caudal peduncle. However, Isbrücker listed these criteria by discarding the synapomophies of other subfamilies,

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thus, they might represent plesioporphic characters for the family. Indeed, in the last published phylogenetic analysis of the Loricariidae based on osteology, Schaefer (1987) found no uniquely derived characters shared by all members of the Hypostominae.

In a recent phylogenetic analysis of loricariids based on mitochondrial 12S and 16S rRNA gene sequences, the monophyly of the Hypostominae was seriously questioned (Montoya-Burgos *et al.*, 1998). This subfamily was divided into five monophyletic groups. The clade comprising *Hypostomus*, the type genus of the subfamily, was found to be nested within Ancistrinae species, rendering the latter paraphyletic. Moreover, the genus *Hypostomus* itself was composed of two unrelated groups of species: *Hypostomus emarginatus* on one side, and all other *Hypostomus* species analyzed on another. Representatives of eight other genera were placed in-between the two *Hypostomus* groups. These results are compatible with the fact that no uniquely derived morphological characters have been found supporting the monophyly of *Hypostomus* (Schaefer, 1986, 1987). Furthermore, in the description of *Hypostomus fonchii* presented in this volume (Weber & Montoya-Burgos, 2002), evidences are provided indicating that the genus *Cochliodon* is a subjective junior synonym of *Hypostomus* (we will still use the *Cochliodon* name in this work for clarity purpose). According to these results, the genus *Hypostomus*, as currently defined, does not form a natural group.

In order to clarify the systematics of *Hypostomus* and its related genera, we present here a new phylogenetic analysis based on 34 Hypostominae representatives, 26 of them belonging to the genus *Hypostomus*, and five Ancistrinae representatives. The mitochondrial D-loop region (or control region) was chosen as phylogenetic marker because its high substitution rate makes it suitable for investigating relationships among closely related species (e. g. Burridge, 1999; Rocha-Olivares *et al.*, 1999).

MATERIAL AND METHODS

DNA EXTRACTIONS AND PCR PRIMERS

Species names, classification, and GenBank accession numbers of all the specimens analyzed are given in Appendix A. Ethanol fixed tissue samples were dried, and total DNA was extracted using QIAamp DNA Mini Kit (Qiagen). In order to amplify by polymerase chain reaction (PCR) the complete mitochondrial D-loop region, we have designed two primers in the tRNA^{Pro} gene, located at the 5' side of the D-loop (DLA-D: 5'- TCCYACCCCTAACTCCCAAAG – 3'; DLB-D: 5' – AGCRYCGGTCTTGTAATCCG – 3'), and two primers in the tRNA^{Phe} gene, located at the 3' side of the D-loop (DLA-R: 5' – AGTCAGGACCAARCCTTTGTGC – 3'; DLB-R: 5'- GGYYCATCTTGACATCTTCAG – 3'). Two internal primers were designed for direct sequencing (DLA I: 5' – TTATTRGRTATGTCTGGG – 3'; DLA II: 5' – CCATGCYAARGCATTCTTTC – 3'). Primers locations are given in Figure 1.

PCR AND CYCLE SEQUENCING

PCR reactions were conducted in a total volume of 50 µl, with 2 units of Taq DNA polymerase (Roche), and 1µl of each primer (10 pmol/µl). Cycle profiles were as follows: 1 min initial denaturation at 94°C followed by 40 cycles with 30 s at 94°C, 30 s at 52-55°C, and 2 min at 72°C. PCR products were purified using the High Pure PCR Product Purification Kit (Roche) and were directly sequenced. Cycle sequencing was carried out using the BigDye Terminator Cycle Sequencing Ready Reaction Kit (Applied Biosystems). The cycle sequencing reaction profile was set to 25 cycles with 15 s at 96°C, 5 s at 50°C, and 4 min at 60°C. Sequences were scored on a 377 PRISM automated sequencer (ABI).

MOLECULAR DATA ANALYSIS

Sequences were aligned manually using the Genetic Data Environment software, version 2.2 (Larsen *et al.,* 1993). Phylogenetic trees were rooted with the sequence of *Hopliancistrus tricornis*, an Ancistrinae species previously identified as a close relative but not included within our ingroup taxa (Montoya-Burgos *et al.,* 1998).

The null hypothesis of base frequency stationary among sequences was evaluated using the χ^2 heterogeneity test as implemented in PAUP*, version 4.0b6 (which ignores correlation due to phylogenetic structure; Swofford, 2000). All sites as well as parsimony-informative sites only were examined in order to assess the potentially confounding effects of constant sites (Waddell *et al.,* 1999).

Maximum Parsimony (MP; Fitch, 1971), distance, and Maximum Likelihood (ML; Felsenstein, 1981) phylogenetic analyzes were performed using PAUP*, version 4.0b6 (Swofford, 2000). All sites with gaps were excluded from the analyzes. In order to determine the best model of sequence evolution for distance and likelihood methods, likelihood scores were determined for three different models: K2P (Kimura, 1980), HKY85 (Hasegawa *et al.,* 1985), and GTR (Yang, 1994). Additionally, the incorporation into each of the models of 1) among-sites rate heterogeneity using the Γ-distribution (Yang, 1993), and 2) the Γ-distribution and the estimated proportion of invariable sites ($\Gamma + I$; Gu *et al.,* 1995), were examined. All model parameters were estimated via ML. Likelihood ratio tests were used to compare likelihood scores obtained for pairs of nested models to determine which model best fit the sequence data (Yang *et al.,* 1994; Swofford *et al.,* 1996). The corrected genetic distances used in this study are the ML distances obtained under the GTR + Γ model. The Neighbor Joining (NJ; Saitou & Nei, 1987) algorithm was used for tree reconstruction.

For the MP method, sites were equally weighted, heuristic searches were performed with 20 replicates of random stepwise addition of taxa and TBR branch swapping.

Nonparametric bootstrapping (Felsenstein, 1985) was performed with 1000 replicates for the distance analyzes, 500 replicates for the MP analyzes, and 200 replicates for the ML analyzes.

In order to determine if alternative hypotheses of relationships were significantly different, the KH test (Kishino & Hasegawa, 1989), and the Tempelton test

(Tempelton, 1983) were used to compare trees under the parsimony criterion, whereas the KH test was used to compare trees under ML. These tests were performed using PAUP*.

RESULTS

STRUCTURE AND BASE COMPOSITION OF THE D-LOOP

The D-loop of the loricariids species analyzed here is characterized by the presence of mini-satellite repeats at the 5' side of the region (Fig. 1), composed by up to 11 repeats of a highly conserved motif of 34 bases. On the 3' side of the D-loop, an AT rich, generally composed and interrupted micro-satellite is present which length can reach up to 480 bases (Fig. 1). The central core of the D-loop is about 660 bp. long, depending on the species. Table 1 shows the mean base composition of the central core for *Hypostomus*, *Cochliodon*, and other genera analyzed. Base composition is homogeneous among the three groups, yet with a general overrepresentation of adenine (A) and a very low frequency of guanine (G). These results are concordant with the chi-square test of homogeneity which indicated stationary base frequency among all taxa, either when considering all sites (P = 1) or when considering informative sites only (P = 0.9999).

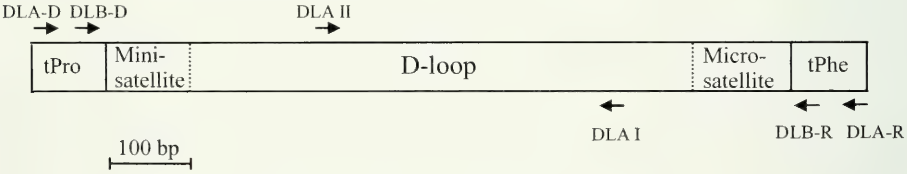

FIG. 1

Schematic representation of loricariids mitochondrial D-loop region (or control region). Amplification and sequencing primers are indicated by an arrow. The control region is characterized by the presence of a mini-satellite at the 5' side, and a micro-satellite at the 3' side.

TABLE 1. Base composition.

Groups	N	A	C	G	T
Hypostomus	26	36.38 ± 0.77	20.71 ± 0.85	11.60 ± 0.52	31.3 ± 0.81
Cochliodon	3	37 ± 0.26	21.13 ± 0.72	10.7 ± 0.47	31.23 ± 0.91
Outgroup	10	36.64 ± 0.96	20.69 ± 1.47	11.52 ± 0.43	31.17 ± 1.11

FINDING AN APPROPRIATE SUBSTITUTION MODEL

Likelihood ratio tests were used to compare nested models of evolution in order to identify the model that best fits the data. The maximum likelihood tree obtained with the K2P model (which is the simplest model tested here) was used to evaluate all models. The results (Table 2) indicate that the incorporation of among-site rate heterogeneity (using the Γ-distribution) results in significantly better likeli-

TABLE 2. Likelihood ratio test comparing nested models.

Model	-ln L			Likelihood ratio tests[a]		
	no Γ	$+\Gamma$	$+\Gamma+I$	$+\Gamma$ vs. no Γ	$+\Gamma+I$ vs. $+\Gamma$	GTR $+\Gamma$ vs. $+\Gamma$
K2P	7925.03	7411.70	7411.31	1026.7* (1)	0.78 (1)	193.57* (7)
HKY85	7791.93	7228.49	7227.88	1126.9* (1)	1.22 (1)	20.72* (4)
GTR	7776.01	7218.13	7217.61	1115.8* (1)	1.04 (1)	—

[a] Likelihood ratio test, $\chi^2 = 2\Delta\ln L$, with degrees of freedom indicated in parentheses.
* Significant (assuming a χ^2 distribution) ; $P < 0.001$

hood scores for all models (P < 0.001). On the contrary, the incorporation of the estimated number of invariable sites (I) did not improve likelihood scores, and, thus, was not considered in further analyzes. The GTR + Γ model was then compared with nested models (K2P + Γ and HKY85 + Γ), resulting in a significantly better performance of the GTR + Γ model ($\chi^2 = 193.57 - 20.72$; P < 0.001). The latter was determined to be the best fit model and was used for phylogenetic analyzes.

Using the GTR + Γ model for correcting pairwise sequence divergences, we have tentatively estimated the intra-specific genetic distance on three *Hypostomus watwata* specimens. Two of them were collected in the Maroni River basin (French Guyana), and showed no substitutions, while the third was collected in the Oyapock River (about 300 Km apart from the Maroni; French Guyana), and showed 3 substitutions compared to the two others, corresponding to a corrected genetic distance of 0.00414 expected substitutions per site.

D-LOOP PHYLOGENY OF *HYPOSTOMUS* AND RELATED GENERA

Phylogenetic reconstructions were performed using (i) the NJ algorithm with GTR + Γ distances, (ii) the ML method under the GTR + Γ model (lnL = -7217.37016; α = 0.37), and (iii) unweighted MP (single most parsimonious tree of length = 1362; CI = 0.454; RI = 0.556). Using the Ancistrinae species *Hopliancistrus tricornis* for rooting the tree, all methods performed yielded very similar topologies (Fig. 2). The first emerging species are *Hemiancistrus medians* followed by *Parancistrus aurantiacus*, which are both Ancistrinae representatives. Then comes a clade composed by two *Hypostomus* species together with *Aphanotorulus ammophilus* and *Isorineloricaria spinosissima* (clade A; Fig. 2). In the MP and ML trees, *Parancistrus aurantiacus* is placed at the base of this clade, but with very low bootstrap support (< 50%). The second emerging clade (clade B, Fig. 2) is well supported by bootstrap analysis (> 90%), and contains representatives of three genera, *Glyptoperichthys*, *Liposarcus*, and *Pterygoplichthys*. Then follows a small clade comprising two South Brazilian Ancistrinae species: *Hemiancistrus chlorostictus* and *H. fuliginosus* (clade C, Fig. 2; bootstrap support = 100%) This last clade represents the sister group to all remaining *Hypostomus* species as well as to all *Cochliodon* species examined (clade D; bootstrap support > 71%).

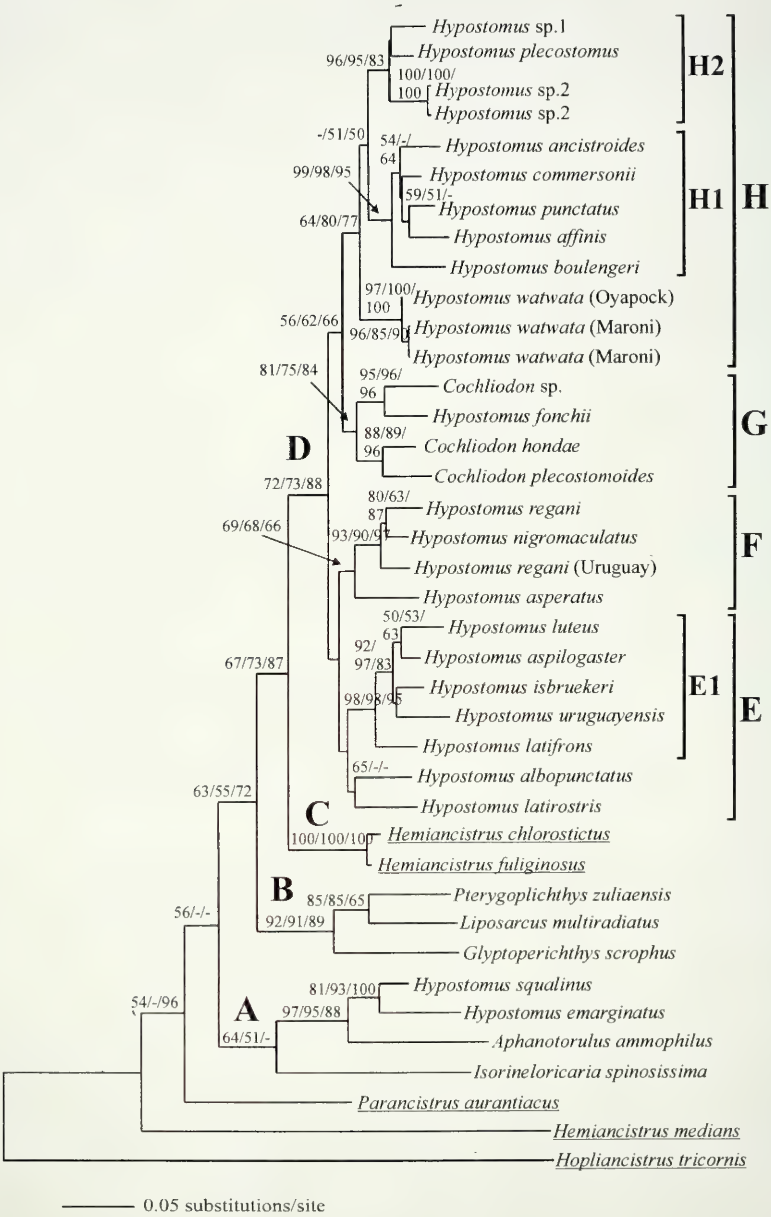

FIG. 2

Neighbor joining tree of *Hypostomus* and related genera based on mitochondrial D-loop sequences. Corrected genetic distances were obtained using the ML method under the GTR + Γ model. Bold letters are abbreviations used for identifying clades. Underlined species names indicate Ancistrinae representatives. Number above branches are bootstrap values ≥ 50 for NJ, ML and MP methods, respectively.

Clade D is subdivided into four monophyletic groups called E, F, G, and H (Fig. 2). Clade E contains a well supported monophyletic group (E1) composed by species inhabiting Rio Paraguay (*H. latifrons*), Rio Uruguay (*H. uruguayensis, H. isbrueckeri, H. luteus*), and Rio Uruguay plus coastal rivers of the Laguna dos Patos system (*H. aspilogaster*). Two other species are placed within clade E: *H. albopunctatus*, distributed in the Upper Paraná basin, and *H. latirostris* collected in the Rio Paraguay. The next clade, named F (Fig. 2), contains *H. asperatus*, *H. nigromaculatus*, and two *H. regani* species, one collected in the Uruguay river, the other collected in the Upper Paraná. The following clade (clade G; Fig. 2) is composed by all *Cochliodon* species together with *Hypostomus fonchii*. The last main clade (clade H, Fig. 2), can be subdivided into two monophyletic groups: H1 and H2. The H1 group comprises *H. boulengeri* known from Rio Paraguay, *H. ancistroides* from upper Rio Paraná, *H. commersonii* inhabiting Rio Uruguay, Paraná, and Paraguay, *H. punctatus* known from upper Rio Paraná and some coastal rivers of South Eastern Brazil, and finally *H. affinis* known from Rio Paraiba do Sul. The H2 group contains the type species, *H. plecostomus*, and two other undescribed species: *Hypostomus* sp. 1, collected in the Rio Parnaíba, and two specimens of *Hypostomus* sp. 2, collected in the Peruvian Amazon.

Regarding the species interrelationships within clade D, ML and MP trees differ from the NJ tree only in (i) the position of *H. plecostomus* which is placed at the base of clade H2; and (ii) the position of *H. ancistroides* and *H. commersonii*, which are found to be sister taxa.

In summary, our phylogenetic tree presents four discordant points in comparison to current Loricariidae systematics: 1) *Hypostomus* is polyphyletic because two species (*H. squalinus* and *H. emarginatus*) are positioned outside of the main *Hypostomus* clade (clade D); 2) the genus *Cochliodon* branches within the main *Hypostomus* clade (clade D); 3) the genus *Hemiancistrus* is polyphyletic; 4) the Ancistrinae subfamily is not monophyletic due to the insertion of *Hemiancistrus chlorostictus* and *H. fuliginosus* (clade C) within Hypostominae genera.

TOPOLOGY TESTS

The robustness of our topology was statistically tested against three alternative hypotheses taken from current systematics: 1) *Hypostomus* is monophyletic; 2) *Cochliodon* (including *H. fonchii*) is the sister group of the main *Hypostomus* clade (Clade D); 3) *Hemiancistrus* is monophyletic. An additional alternative topology was tested in which *Hypostomus fonchii* was excluded from the *Cochliodon* clade, due to its atypical *Cochliodon* dentition.

The Kishino and Hasegawa (KH) test was performed using ML under the GTR + Γ model. This test plus the Tempelton test were performed under the unweighted MP criterion. The results (Table 3) indicate that the enforced monophyly of *Hypostomus* is significantly less supported by our data than its polyphyly, as suggested by our phylogenetic tree ($P < 0.001$). The enforced sister group relationship between *Hypostomus* species of clade D and *Cochliodon* species (including *Hypostomus fonchii*) can not be rejected by our data at a confidence level of $P < 0.05$. As to the

TABLE 3. Topology tests.

	ML (GTR + Γ)			unweighted MP			
			KH			KH	Tempelton
Topological constraints	-lnL	ΔlnL	*P*	L	ΔL	*P*	*P*
1. ML or MP tree	7210.02	best		1362	best		
2. *Hypostomus* monophyletic	7301.18	91.15	<0.001*	1402	40	<0.001*	<0.001*
3. *Coch.* excluded from clade D	7218.36	8.34	0.067	1366	4	0.051	0.051
4. *Hemiancistrus* monophyletic	7242.20	32.17	0.002*	1402	40	<0.001*	<0.001*
5. *H. fonchii* excluded from *Coch.*	7222.17	12.14	0.030*	1373	11	<0.001*	<0.001*

Note.- The following abbreviation is used: *Coch.* = *Cochliodon.*
* $P < 0.05$.

enforced monophyly of *Hemiancistrus*, it is significantly rejected (P < 0.01), implying the rejection of the monophyly of Ancistrinae. Finally, the alternative in which *Hypostomus fonchii* is excluded from the *Cochliodon* clade produces a significantly lower score than our original topology (P < 0.05).

DISCUSSION

WHAT IS *HYPOSTOMUS* ?

The genus *Hypostomus* Lacepède, 1803, is one of the most species-rich and diverse group of Neotropical catfishes, comprising about 120 species. Species belonging to this genus occur almost everywhere in tropical and south temperate South America. Although Isbrücker (1980) listed a number of characters suitable for recognizing *Hypostomus* at the generic level, Schaefer (1986, 1987) found no osteological derived characters that can be used to uniquely diagnose this genus. Thus, no evidences have been found yet supporting the monophyly of this genus and, moreover, species identification is in general a fastidious exercise. Our phylogenetic tree indicate that *Hypostomus*, as currently defined, is not monophyletic. However, among the 23 species analyzed here, only two of them are excluded from the main *Hypostomus* clade (clade D, Fig. 2; Table 3). These two species, *H. emarginatus* and *H. squalinus*, cluster together and are placed with *Aphanotorulus ammophilus*.

Following Isbrücker & Nijssen (1982), *Aphanotorulus* is the most closely related genus to *Hypostomus*, and is distinguished only by the numerous and irregular papilla found in the buccal cavity. Later on, Armbruster & Page (1996) proposed new diagnostic characters for this genus, and suggested that *Aphanotorulus* is closely related to *Isorineloricaria* and *Hypostomus emarginatus*, probably making *Hypostomus* paraphyletic. In the last revision of *Aphanotorulus*, Armbruster (1998) recognized only two species: *A. ammophilus* from the Orinoco basin and *A. unicolor* from the Amazon basin. This author presents also new synapomorphies supporting the genus, and provides further evidences indicating a close relationship between *Aphanotorulus*, *Isorineloricaria, Hypostomus emarginatus*, and also *H. squalinus*. Astonishingly, among these evidences, Armbruster (1998) gives a synapomorphic character specifically uniting *Aphanotorulus* with *H. emarginatus* and *H. squalinus*, and excluding *Isorinaloricaria.* This shared feature is the presence of a lateral line that continues onto the elongate plate that covers the base of the caudal fin rays and suggests that *Aphanotorulus*, *H. emarginatus*, and *H. squalinus* are more closely related with each other than to *Isorineloricaria.* This is exactly what our phylogeny proposes; *Isorineloricaria* is placed at the base of the "*Aphanotorulus* clade" comprising *Aphanotorulus*, *H. emarginatus* and *H. squalinus.* However, in the last but still unpublished osteological phylogeny of Loricariidae, Armbruster (1997) found that *Isorineloricaria* is more closely related to *H. emarginatus* and *Aphanotorulus* than to *H. squalinus.* Furthermore, this author found that *Isorineloricaria* and *Aphanotorulus* are placed within his *Hypostomus* clade and, therefore, suggested that these two genera are *Hypostomus* synonyms. In our phylogeny, the clade comprising *Isorineloricaria*, *Aphanotorulus*, *H. emarginatus*, and *H. squalinus* branches far apart from our main *Hypostomus* clade (clade D; Fig. 2). In opposition to Armbruster's (1997) proposal, our results suggest that *H. emarginatus* and *H. squalinus* should be excluded from *Hypostomus* and should be placed within *Aphanotorulus.* Among the *Hypostomus* species examined here, only those grouped in clade D (Fig. 2) should be retained in this genus. The exclusion of *H. emarginatus* from the *Hypostomus* clade and its close relationship with *Aphanotorulus* is also supported by the analysis of partial mitochondrial 12S and 16S rRNA genes, with a bootstrap support of 95% (Montoya-Burgos *et al.*, 1998). *Hypostomus squalinus* was not included in that study. Morphologically, members of the *Aphanotorulus* clade (*Aphanotorulus* plus *H. emarginatus* and *H. squalinus*) are easily distinguishable from *Hypostomus* by their elongated body and the ventrally flattened caudal peduncle in cross section, with markedly carinated ventrolateral scutes.

In the present investigation, all phylogenetic methods unequivocally place *Cochliodon* within the main *Hypostomus* clade (clade D; Fig. 2), with bootstrap support ranging from 72 to 88. The hypothesis that *Cochliodon* may be the sister group of *Hypostomus* of clade D was not rejected by the topological tests performed at a confidence level of $P < 0.05$; the P values being 0.051 and 0.067 (Table 3). Yet, if the confidence level is slightly increased to $P < 0.07$ (which is still a reasonable level), then this alternative hypothesis is significantly rejected by our data. Moreover, the confident position of *Hypostomus fonchii* within the *Cochliodon* clade (Fig. 2, Table 3) supports the morphological evidences presented by Weber & Montoya-Burgos (2002) indicating that *Cochliodon* is a *Hypostomus* synonym. Indeed, until the recent discovery of *H. fonchii*, only dentition traits distinguished *Cochliodon* from *Hypostomus.* Because the tooth of *H. fonchii* is nearly intermediate between *Hypostomus* and *Cochliodon* tooth, and because this new species emerges within the *Cochliodon* clade, morphological and genetic evidences indicate that the dentition characters diagnosing *Cochliodon* are not longer valid. For all these reasons, we suggest that *Cochliodon* should be considered as a subjective junior synonym of *Hypostomus* (Weber & Montoya-Burgos, 2002). This idea has also been proposed by Armbruster (1997), who worked on osteological characters.

Within the main *Hypostomus* clade (clade D), species of clades E and F (Fig. 2) can be tentatively characterized by the shared presence of wide mandibles, in opposition to species of clade G and H, which display much narrow mandibles. This mouth characteristic was previously noticed by Muller & Weber (1992), who defined two *Hypostomus* groups: the *H. regani* group (wide mandibles with numerous teeth bearing an elongated crown), and the *H. plecostomus* group (medium size mandibles with teeth bearing a short crown).

The two *Hypostomus regani* specimens examined, one collected in the Upper Paraná, the other in the Uruguay river, do not cluster together and are separated by a marked genetic distance. The corrected genetic distance obtained between these two species is 0.08, that is, 19.5 times more than the intra-specific distance of 0.00414 estimated among *H. watwata* specimens. It is suggested that these two specimens might belong to distinct species. Because the type locality of *H. regani* is located in upper Paraná, the specimen collected in that basin is correctly referred to as *H. regani*. Concerning the specimen captured in the Uruguay river, we suggest to revalidate the species *Hypostomus luteomaculatus*, which was described from the Uruguay river but was considered as a junior synonym of *H. regani* by Reis *et al.* (1990) on the basis of insufficient morphological diagnostic differences. In our phylogenetic tree, a morphologically distinct species (*H. nigromaculatus*) clusters with *H. regani* (Fig. 1). From a morphological point of view, this result seems aberrant and would invoke a morphological stasis experienced by *H. regani* and *H. luteomaculatus* since their last common ancestor to be explained. However, it has been shown with many unrelated groups of fishes that extremely few conspecific populations occur in both the Upper Paraná and the Uruguay river, as noticed by Reis *et al.* (1990).

The view of *Hypostomus* proposed here provides a fundamental new framework for further investigations based on morphology and/or genetics.

POLYPHYLY OF THE ANCISTRINAE

The subfamily Ancistrinae was separated from the Hypostominae on the basis of the shared presence of evertible interopercular odontodes in the Ancistrinae (Isbrücker, 1980). Later on, Schaefer (1986, 1987) found uniquely derived osteological characters supporting the monophyly of ancistrines, yet most of them are related to the evertible odontodes. In a previous phylogeny of Loricariidae based on mitochondrial 12S and 16S rRNA gene sequences (Montoya-Burgos *et al.,* 1997, 1998), evidences indicating that Ancistrinae is a paraphyletic group were provided. These authors have argued that the evertible odontodes have most probably appeared once in the evolutionary history of loricariids but have then disappeared independently in several lineages, implying that the use of the evertible-odontodes criterion leads to the formation of a paraphyletic group. Here, the polyphyly of Ancistrinae is based on the confident placement of two *Hemiancistrus* species (which belongs to the Ancistrinae) within a clade composed by Hypostominae representatives (Fig. 2; Table 3). Thus, our results confirm for a subset of taxa, the previous conclusions based on mitochondrial 12S and 16S rRNA genes (Montoya-Burgos *et al.,* 1997, 1998). It is however not excluded that mitochondrial gene phylogenies do not reflect properly species phylogeny. Future analyses of nuclear markers could clear up this molecular-morphological conflict.

POLYPHYLY OF *HEMIANCISTRUS*

Aside from demonstrating the polyphyly of the Ancistrinae, the genus *Hemiancistrus* is shown here as polyphyletic. Indeed, the type species, *Hemiancistrus medians*, is placed near the root of the tree whereas *Hemiancistrus chlorostictus* and *H. fuliginosus* are placed as the sister taxa of the *Hypostomus* representatives of clade D (Fig. 2). The topology tests performed (Table 3) reject with strong confidence the enforced monophyly of the *Hemiancistrus* species examined herein. In a previous osteological analysis of the Ancistrinae, Schaefer (1986) found no skeletal autapomorphies for this genus and recognized that *Hemiancistrus* alpha-level taxonomy is the most problematic within the Ancistrinae. The body shape of *Hemiancistrus* is reminiscent of *Hypostomus* (Isbrücker, 1980; Schaefer, 1986) and of the Ancistrinae genus *Peckoltia* (Isbrücker, 1980). Setting apart the evertible odontodes, the duality of *Hemiancistrus* traits may be well explained by its polyphyletic origin, as indicated by our results.

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REFERENCES

ARMBRUSTER, J. W. 1997. Phylogenetic relationships of the sucker-mouth armored catfishes (Loricariidae) with particular emphasis on the Ancistrinae, Hypostominae, and Neoplecostominae. *Unpublished Ph.D. thesis, University of Illinois at Urbana-Champaign, Urbana, Illinois*, 236 pp., 134 figs.

ARMBRUSTER, J. W. 1998. Review of the loricariid catfish genus *Aphanotorulus* and redescription of *A. unicolor* (Teleostei: Siluriformes). *Ichthyological Exploration of Freshwaters, München* 8(3): 253-262.

ARMBRUSTER, J. W. & PAGE, L. M. 1996. Redescription of *Aphanotorulus* (Teleostei: Loricariidae) with description of one new species, *A. ammophilus*, from the Rio Orinoco basin. *Copeia*: 379-389.

BURRIDGE, C. P. 1999. Molecular phylogeny of *Nemadactylus* and *Acantholatris* (Perciformes : Cirrhitoidea: Cheilodactylidae), with implications for taxonomy and biogeography. *Molecular Phylogenetics and Evolution* 13(1): 93-109.

FELSENSTEIN, J. 1981. Evolutionary trees from DNA sequences: a maximum likelihood approach. *Journal of Molecular Evolution* 17: 368-376.

FELSENSTEIN, J. 1985. Confidence limits on phylogenies: an approach using the bootstrap. *Evolution* 39: 783-791.

FITCH, W. M. 1971. Toward defining the course of evolution: minimum change for a specific tree topology. *Systematic Zoology* 20: 406-416.

GU, X., FU, Y.-X. & LI, W.-H. 1995. Maximum likelihood estimation of the heterogeneity of substitution rate among nucleotide sites. *Molecular Biology and Evolution* 12: 546-557.

HASEGAWA, M., KISHINO, H. & YANO, T. 1985. Dating the human-ape splitting by a molecular clock of mitochondrial DNA. *Journal of Molecular Evolution* 22: 672-677.

ISBRÜCKER, I. J. H. 1980. Classification and catalogue of the mailed Loricariidae (Pisces, Siluriformes). *Verslagen en technische Genevens, Universiteit van Amsterdam*, no 22, 181 pp.

ISBRÜCKER, I. J. & NIJSSEN, H. 1982. *Aphanotorulus frankei*, une espèce et un genre nouveaux de poissons-chats cuirassés du bassin du Rio Ucayali au Pérou (Pisces, Siluriformes, Loricariidae). *Revue Française d'Aquariologie et d'Herpétologie* 9: 105-110.

KIMURA, M. 1980. A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. *Journal of Molecular Evolution* 16: 111-120.

KISHINO, H. & HASEGAWA, M. 1989. Evaluation of the maximum likelihood estimate of the evolutionary tree topologies from DNA sequence data, and the branching order in Hominoidea. *Journal of Molecular Evolution* 29: 170-179.

LARSEN, N., OLSEN, G. J., MAIDAK, B. L., MCCAUGHEY, M. J., OVERBEEK, R., MACKE, T. J., MARSH, T. L. & WOESE, C. R. 1993. The ribosomal database project. *Nucleic Acids Research* 21: 3021-3023.

MONTOYA-BURGOS J. I., MULLER, S., WEBER, C. & PAWLOWSKI, J. 1997. Phylogenetic relationships between Hypostominae and Ancistrinae (Siluroidei: Loricariidae): first results from mitochondrial 12S and 16S rRNA gene sequences. *Revue suisse de Zoologie* 104(1): 185-198.

MONTOYA-BURGOS, J. I., MULLER, S., WEBER, C. & PAWLOWSKI, J. 1998. Phylogenetic relationships of the Loricariidae (Siluriformes) based on mitochondrial rRNA gene sequences (pp. 363-374). *In*: MALABARBA, L. R., REIS, R. E., VARI, R. P., LUCENA, Z. M. S & LUCENA, C. A. S. (eds). Phylogeny and Classification of Neotropical Fishes. *Edipucrs, Porto Alegre, Brasil.*

MULLER, S. & WEBER, C. 1992. Les dents des sous-familles Hypostominae et Ancistrinae (Pisces, Siluriformes, Loricariidae) et leur valeur taxonomique. *Revue suisse de Zoologie* 99(4):747-754.

REIS, R. E., WEBER, C. & MALABARBA, L. R. 1990. Review of the genus *Hypostomus* Lacépède, 1803 from Southern Brazil, with descriptions of three new species (Pisces, Siluriformes, Loricariidae). *Revue suisse de Zoologie* 97(3): 729-766.

ROCHA-OLIVARES, A., ROSENBLATT, R. H. & VETTER, R. D. 1999. Molecular evolution, systematics, and zoogeography of the rockfish subgenus *Sebastomus* (Sebastes, Scorpaenidae) based on mitochondrial cytochrome b and control region sequences. *Molecular Phylogenetics and Evolution* 11(3): 441-458.

SAITOU, N. & NEI, M. 1987. The neighbor-joining method: a new method for reconstructing phylogenetic trees. *Molecular Biology and Evolution* 4: 406-425.

SCHAEFER, S. A. 1986. Historical biology of the loricariid catfishes: phylogenetics and functional morphology. *Unpublished Ph.D. Dissertation, University of Chicago, Illinois,* 198 pp.

SCHAEFER, S. A. 1987. Osteology of *Hypostomus plecostomus* (Linnaeus), with a phylogenetic analysis of the loricariid subfamilies (Pisces: Siluroidei). *Contribution to Science* 394: 1-31.

SWOFFORD, D. L. 2000. PAUP*. Phylogenetic Analysis Using Parsimony (*and Other Methods). Version 4. *Sinauer Associates, Sunderland, Massachusetts.*

SWOFFORD, D. L., OLSEN, G. J., WADDELL, P. J. & HILLIS, D. M. 1996. Phylogenetic inference (pp. 407-514). *In*: HILLIS, D. M., MORITZ, C. & MABLE, B. K. (eds). Molecular systematics. 2nd edition. *Sinauer, Sunderland, Massachusetts.*

TEMPELTON, A. R. 1983. Phylogenetic inference from restriction endonuclease cleavage site maps with particular reference to the humans and apes. *Evolution* 37: 221-244.

Waddell, P. J., Cao, Y., Hauf, J. & Hasegawa, M. 1999. Using novel phylogenetic methods to evaluate mammalian mtDNA, including amino acid-invariant sites-LogDet plus site stripping, to detect internal conflicts in the data, with special reference to the positions of hedgehog, armadillo, and elephant. *Systematic Biology* 48: 31-53.

Weber, C. & Montoya-Burgos, J. I. 2002. *Hypostomus fonchii* sp. n. (Siluriformes: Loricariidae) from Peru, a key species suggesting the synonymy of *Cochliodon* with *Hypostomus*. *Revue suisse de Zoologie* 109(2): 355-368.

Yang, Z. 1993. Maximum-likelihood estimation of phylogeny from DNA sequences when substitution rates differ over sites. *Molecular Biology and Evolution* 10: 1396-1401.

Yang, Z. 1994. Estimating the pattern of nucleotide substitution. *Journal of Molecular Evolution* 39: 105-111.

Yang, Z., Goldman, N. & Friday, A. 1994. Comparison of models for nucleotide substitution used in maximum-likelihood phylogenetic estimation. *Molecular Biology and Evolution* 11: 316-324.

APPENDIX. Specimens analyzed.

Species	Subfamily	Collection number	GenBank number
Hopliancistrus tricornis	Ancistrinae	MHNG 2588.51	AJ318367
Hemiancistrus medians	Ancistrinae	MHNG 2593.85	AJ318368
Hemiancistrus fuliginosus	Ancistrinae	MCP 20417	AJ318359
Hemiancistrus chlorostictus	Ancistrinae	MCP 19941	AJ318345
Parancistrus aurantiacus	Ancistrinae	MHNG 2583.39	AJ318366
Isorineloricaria spinosissima	Hypostominae	MHNG 2575.51	AJ318365
Aphanotorulus ammophilus	Hypostominae	INHS 34738	AJ318346
Glyptoperichthys scrophus	Hypostominae	INHS 38845	AJ318362
Liposarcus multiradiatus	Hypostominae	INHS 34423	AJ318361
Pterygoplichthys zuliaensis	Hypostominae	INHS 35384	AJ318360
Cochliodon hondae	Hypostominae	INHS 35598	AJ318348
Cochliodon plecostomoides	Hypostominae	INHS 34687	AJ318349
Cochliodon sp.	Hypostominae	PSM 06-2053	AJ318347
Hypostomus affinis	Hypostominae	MHNG 2587.55	AJ318358
Hypostomus albopunctatus	Hypostominae	MHNG 2547.18	AJ318379
Hypostomus ancistroides	Hypostominae	MHNG 2602.91	AJ318369
Hypostomus asperatus	Hypostominae	PSM 06-EF2	AJ318370
Hypostomus aspilogaster	Hypostominae	MCP 21319	AJ318375
Hypostomus boulengeri	Hypostominae	MHNG 2519.23	AJ318344
Hypostomus commersonii	Hypostominae	MCP 20212	AJ318356
Hypostomus emarginatus	Hypostominae	MHNG 2588.62	AJ818364
Hypostomus fonchii	Hypostominae	MHNG 2613.67	AJ318350
Hypostomus isbrueckeri	Hypostominae	MCP 21125	AJ318376
Hypostomus latifrons	Hypostominae	MHNG 2528.16	AJ318378
Hypostomus latirostris	Hypostominae	MHNG 2528.11	AJ318373
Hypostomus luteus	Hypostominae	MCP 19991	AJ318374
Hypostomus nigromaculatus	Hypostominae	MZUEL Tib012	AJ318355
Hypostomus plecostomus	Hypostominae	MHNG GF98-002	AJ318351
Hypostomus punctatus	Hypostominae	MHNG 2543.27	AJ318357
Hypostomus regani	Hypostominae	MHNG 2547.17	AJ318371
Hypostomus regani (Uruguay)	Hypostominae	MCP 19989	AJ318372
Hypostomus squalinus	Hypostominae	INHS 34684	AJ318363
Hypostomus uruguayensis	Hypostominae	MCP 19990	AJ318377
Hypostomus watwata (Maroni)	Hypostominae	MHNG GF98-144	AJ318353

Hypostomus watwata (Maroni)	Hypostominae	MHNG GF98-146	AJ318354
Hypostomus watwata (Oyapock)	Hypostominae	MHNG GF99-162	AJ318352
Hypostomus sp. 1	Hypostominae	MHNG 2602.64	AJ315762
Hypostomus sp. 2 (Ucayali)	Hypostominae	MHNG 2588.82	AJ315763
Hypostomus sp. 2 (Caño Piro)	Hypostominae	MHNG 2588.77	AJ315764

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Three extraordinary new species of Psocoptera (Insecta) from Colombia, Malaysia and Thailand (Epipsocidae, Lachesillidae, Ectopsocidae)

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Three extraordinary new species of Psocoptera (Insecta) from Colombia, Malaysia and Thailand (Epipsocidae, Lachesillidae, Ectopsocidae). - The following species are described and illustrated: *Odontopsocus compactus* sp. n. (Colombia), *Lachesilla hirsuta* sp. n. (Thailand), *Ectopsocus venosus* sp. n. (East Malaysia: Sabah). Each of them is characterized by a morphological structure which is unusual within the genus concerned and, in the case of *Odontopsocus compactus*, unique within the order Psocoptera. The presence of a cup-like, unsegmented and heavily sclerotized abdominal carapace in this species is discussed in the light of its mode of life in humid moss and litter and is compared with similar convergent structures in other psocids.

Key-words: Psocoptera - Epipsocidae - Lachesillidae - Ectopsocidae - new species - Colombia - Malaysia - Thailand - litter dwellers.

INTRODUCTION

Some years ago, when sorting out samples of unidentified tropical Psocoptera in the collection of the Natural History Museum of Geneva (MHNG), I was particularly impressed by three species belonging to Epipsocidae, Lachesillidae and Ectopsocidae respectively, each showing a striking morphological character which is completely unusual for members of the family concerned: an apterous epipsocid female from Colombia with heavily sclerotized abdominal terga, fused to form a compact cup-like carapace; a lachesillid from Thailand with strongly pilose head and forewings; an ectopsocid from East Malaysia (Sabah) with atypical forewing venation (veins *rs* and *m* multi-branched).

My first reaction was to think that each of these species could represent an unknown genus. But further morphological study of the material showed that in each case general and genital characters correspond fairly well to a described genus of the family concerned. Therefore I hesitate to consider the extraordinary characters mentioned above as of generic value unless they have been observed in other species. The

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three new species are placed here in the genera *Odontopsocus* Badonnel, *Lachesilla* Westwood and *Ectopsocus* McLachlan respectively. Their description can be considered as a contribution to the knowledge of character range within the genera concerned and, in the case of *Odontopsocus*, it may illustrate a morphological adaptation to the hemiedaphic mode of life of this species in humid moss and litter.

The following abbreviations are used in the descriptions: BL = body length; A = antenna length; FW = forewing length; F = length of hind femur; T = length of hind tibia; t1, t2 = length of hind tarsomeres (from condyle to condyle); IO/D = shortest distance between compound eyes divided by antero-posterior diameter of compound eye, in dorsal view of head; f1, f2, ... = antennal flagellomeres; v1, v2, v3 = ventral, dorsal and external valvula of gonapophyses. For standard abbreviations concerning wing morphology, see Lienhard (1998).

TAXONOMIC TREATMENT

Odontopsocus compactus sp. n. Figs 1, 2

MATERIAL

Holotype ♀ (MHNG, slide no 7450). COLOMBIA: Dept. Magdalena: Northern Sierra Nevada de Santa Marta, near San Lorenzo, 2250 m, humid bamboo forest, in moss and litter, 22.VIII.1985, leg. H.-G. Müller.

Paratype ♀ (MHNG, in alcohol). Same locality as holotype, but 2200 m, in moss and litter on wayside, 18.-25.VIII.1985, leg. H.-G. Müller.

DIAGNOSIS

Female apterous, with fused and heavily scerotized abdominal terga forming a compact cup-like carapace.

DESCRIPTION (♀)

Coloration. Head and abdominal terga blackish brown, glossy; compound eyes black; antennae brown; maxillary palps, thorax, legs and terminalia dark brown; abdominal sterna whitish with some red-brown hypodermal pigment.

Morphology. Apterous. Habitus characteristic (figs 1g; 2a, b), due to the completely fused abdominal terga forming a heavily sclerotized cup-like carapace, which overlaps anteriorly the weakly developed thoracic terga, so that, in a contracted specimen, its anterior margin fits the posterior part of the normally rounded vertex. The glossy dorsal shield shows no trace of segmentation, it is completely glabrous but bears some very fine hyaline pores. Its prominent anterior margin is sharply delimited, bearing a membranous cuticula on its ventral side. The lateral margins of the shield are also sharply delimited, slightly prominent laterally and bearing the spiracles on their membranous ventral surface. The ventral side of the abdomen is entirely membranous, except the somewhat sclerotized subgenital plate.

Compound eyes relatively large (IO/D = 1.5), posteriorly protruding beyond vertex (figs 1g, 2a). Ocelli absent. Antennae relatively short, flagellomeres with some long setae, the longest of them somewhat exceeding the length of the corresponding flagellomere, f1 slightly curved, f5, f7 and f9 only about half as long as adjacent

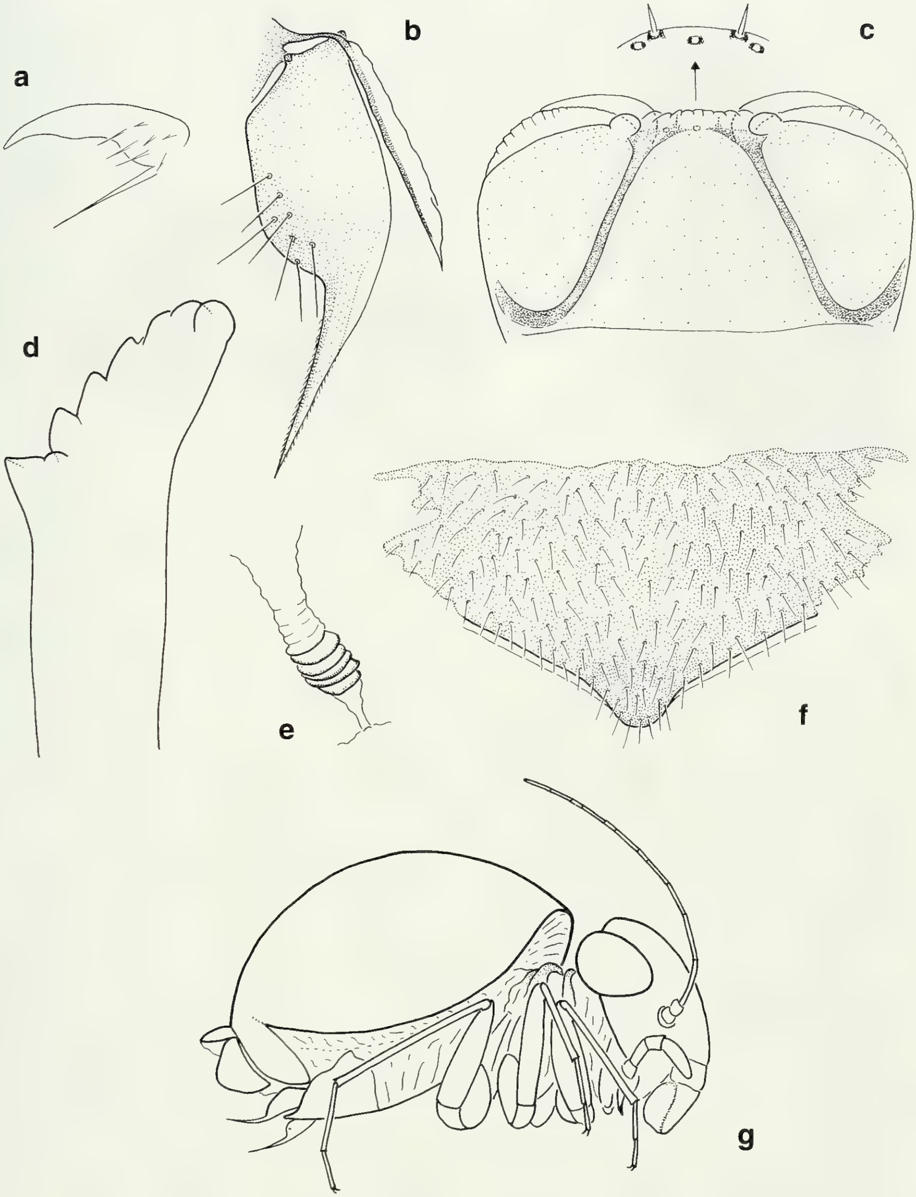

FIG. 1

Odontopsocus compactus sp. n., female: **a**, pretarsal claw; **b**, gonapophyses; **c**, labrum (pilosity not shown), with detail of marginal sensilla; **d**, lacinial tip; **e**, spermathecal duct; **f**, subgenital plate; **g**, habitus, lateral view (pilosity, pigmentation and sclerotization not shown).

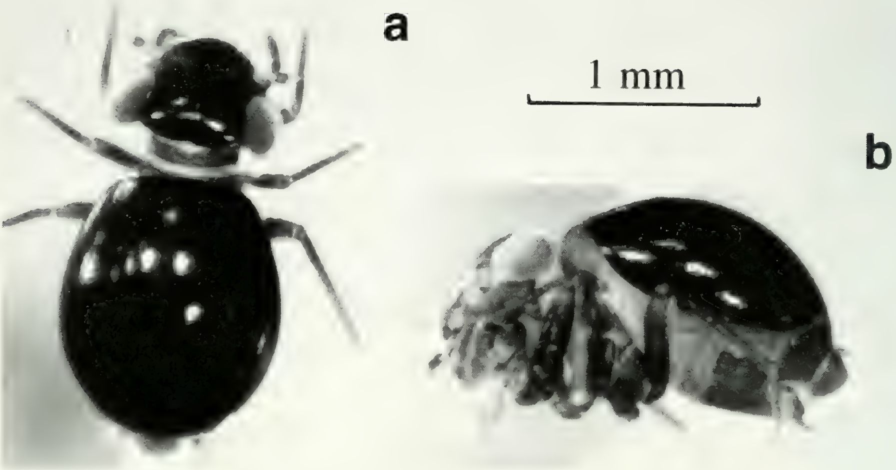

FIG. 2

Odontopsocus compactus sp. n., female, habitus: **a**, holotype, dorsal view; **b**, paratype, lateral view.

flagellomeres. Lacinial tip with long, relatively slender, denticulate outer cusp (fig. 1d). Labrum as in fig. 1c. No cones on femora. Pretarsal claws without preapical denticle (fig. 1a). Pearman's organ on hind coxa absent.

Clunium medially fused with abdominal carapace, laterally free (figs 1g, 2b). Epiproct and paraprocts free, simple, no trichobothria on paraprocts. Subgenital plate with a weakly developed rounded apical lobe (fig. 1f). Gonapophyses (fig. 1b): v1 present, joined by a sclerotic strip to clunium, v3 fused with v2, forming a slight swelling on its side, bearing some hairs, v2 terminating in a long acuminate process. Spermatheca membranous, its duct with some slightly sclerotized annulations (fig. 1e), spermapore without sclerotization.

Measurements (♀ holotype). BL = 1.8 mm; A = 1.2 mm; F = 470 µm; T = 630 µm; t1 = 240 µm; t2 = 160 µm.

Remark. The male of this species (predicted to be fully winged, as all known epipsocid males are) is not yet known, but the presence of sperm in the spermatheca of the dissected female gives evidence of the bisexuality of the species.

DISCUSSION

Based on female characters only, the generic placement is difficult. According to the revised diagnoses of the episocid genera (Mockford, 1998) the species is probably best placed in *Odontopsocus* Badonnel, due to the absence of the preapical denticle of pretarsal claws, the aptery of females and the long, relatively slender, denticulate outer cusp of lacinial tip. This genus is known from Venezuela, from where two species have been described: *O. orghidani* Badonnel, the type species (Badonnel, 1987) and *O. badonneli* Mockford (Mockford, 1996), both known in female sex only. Before defining a new genus for the Colombian species, based on the presence of the undoubtedly apomorphic abdominal carapace, I prefer to wait for the availability of more material, particularly males. The following observations on apterous females of two other psocid genera endorse this decision; some variation is observed concerning abdominal sclerotization between different species of the same genus.

In the family Epipsocidae, the presence of fused and heavily sclerotized abdominal terga in apterous females is known in one species of the Oriental genus *Hinduipsocus* Badonnel (cf. Badonnel, 1981: fig. 51), but in this species, *H. atratus* Badonnel, the abdominal terga do not form a capsule-like structure, overlapping thoracic terga, as it is present in the new species. In the other three known species of *Hinduipsocus* some abdominal segmentation is always visible and terga are more or less membranous, at least in the apical half of the abdomen; in *H. coleoptratus* New the abdominal terga 1 to 4 are heavily sclerotized, similar to *H. atratus*, while the other preclunial terga are membranous (cf. New, 1987: figs 1-3). Another example within the suborder Psocomorpha, for the presence of sclerotized or membranous abdominal terga in apterous females of different species of the same genus, is *Lesneia* Badonnel (Elipsocidae) (cf. Badonnel, 1981). In this African genus one species with membranous abdominal terga exists besides two species with sclerotized abdominal terga (cf. Badonnel, 1931, 1963; Broadhead & Richards, 1982). Also in *Lesneia* the sclerotized dorsal shield of the abdomen is of normal shape and does not form a capsule-like structure (cf. Badonnel, 1931: fig. 19). In both cases, *Hinduipsocus* and *Lesneia*, the apomorphic sclerotization of the abdominal terga cannot be considered as a generic character and the definition of further generic divisions within these otherwise very homogeneous series of species seems not to be justified.

As mentioned in the above comparisons with *Hinduipsocus* and *Lesneia*, the abdominal shields observed in these genera are of normal shape and not differentiated as cup-like capsules. The presence of such an abdominal capsule in *Odontopsocus compactus* is unique in the Psocoptera. It represents probably an adaptation to life in humid moss and litter, from where the two known specimens have been extracted. A striking similarity in habitus, due to morphological convergence, can be observed in the females of some litter-dwelling Troctopsocidae belonging to the Oriental genus *Coleotroctellus* Lienhard (cf. Lienhard & Mockford, 1997: fig. 10). In this genus, the capsule is not formed by the sclerotized abdominal terga but by the strongly modified, elytriform forewings. The function of both structures may be the same, but no detailed biological observations on these interesting litter-dwelling psocids have been made up to now. As indicated above (see "Remark") the males of the new epipsocid species are probably fully winged, with normally shaped forewings, as are the males of *Coleotroctellus* (cf. Lienhard & Mockford, 1997). In these cases the mobility of the males represents apparently a more important evolutionary advantage than it could be offered by an efficient abdominal protection in both sexes.

Elytriform forewings with more or less modified venation but less sclerotized membrane have been observed in two other hemiedaphic species of Troctopsocidae: *Protroctopsocus enigmaticus* Mockford and *Chelyopsocus garganicus* Lienhard. In

P. enigmaticus normally winged females are also known, but they are much rarer than the brachypterous females with elytriform forewings (cf. Mockford, 1967: 132), all known males have elytriform forewings (cf. Garcia Aldrete, 1982a: fig. 2). No wing polymorphism has been observed in *Ch. garganicus* (cf. Lienhard, 1998: fig. 43, pl.9g), the male of this species is not known.

Within Psocoptera, coleopterous-like habitus due to elytriform forewings is also known in Sphaeropsocidae and in an isolated case of Psocidae. It may be interpreted as an adaptation to litter-dwelling in the hemiedaphic family Sphaeropsocidae, e. g. *Sphaeropsocopsis recens* (Hickman), found in dry grass tussocks in Tasmania (Hickman, 1934: fig. 4A) and in *Eucalyptus* litter in South Australia (cf. Smithers, 1984). Unfortunately nothing is known on the biology of the only genus of Psocidae where heavily sclerotized elytriform forewings have been observed: *Elytropsocus* Smithers & Thornton, with only one species known, *E. coleoptratus* Smithers & Thornton, from New Guinea (cf. Smithers & Thornton, 1981: fig. 80).

Lachesilla hirsuta sp. n. Fig. 3

MATERIAL

Holotype ♀ (MHNG, slide no 7447 and alcohol). THAILAND: Chiang Mai Province: Doi Suthep (Doi Suthep-Pui National Park), 670 m, evergreen gallery forest, 15.II.1996, leg. P. Schwendinger.

Paratypes. 2♀ (MHNG). THAILAND: Chiang Mai Province: Doi Suthep, near Monthathan Waterfall, 650 m, mixed deciduous forest, pitfall trap, 10.I.-6.II.1997 (1♀, lacking abdomen), 6.II.-26.II.1997 (1♀, lacking left forewing), leg. P. Schwendinger.

DIAGNOSIS

Head and mesonotum densely pilose, about 10 particularly long hairs on vertex (fig. 3h). Veins of forewing (except *pcu*) with one row of relatively long hairs (sometimes two rows on *an*), pilosity denser and longer in basal half of the wing than in apical half; forewing with a characteristic colour pattern (fig. 3a). Female gonapophyses (fig. 3g): two pairs of valvulae present, v2 glabrous, v3 pilose. 9th sternum with characteristic sclerotization around spermapore (fig. 3g).

DESCRIPTION (♀)

Coloration. Head light to medium brown with some small dark patches, postclypeus with brown longitudinal stripes, compound eyes black, antennae, thorax and terminalia brown, legs light brown, abdomen yellowish with some red-brown hypodermal pigment. Forewing with a large brown patch in subcentral position, apical half clear (fig. 3a), hindwing clear (fig. 3b).

Morphology. Head (fig. 3h) and mesonotum densely pilose, with some particularly long dorsal hairs, about 10 of them on vertex, the longest of them about 1.5x as long as the eye diameter. Compound eyes relatively small (IO/D = 2.6), ocelli well developed. Antennae pilose, longest setae in apical half of the antenna more than twice the length of the corresponding flagellomeres. Lacinial tip as in fig. 3f. Pretarsal claw with a preapical denticle, apex of pulvillus slightly expanded (fig. 3i). Pearman's organ on hind coxa well developed. Forewing (fig. 3a) with one row of relatively long

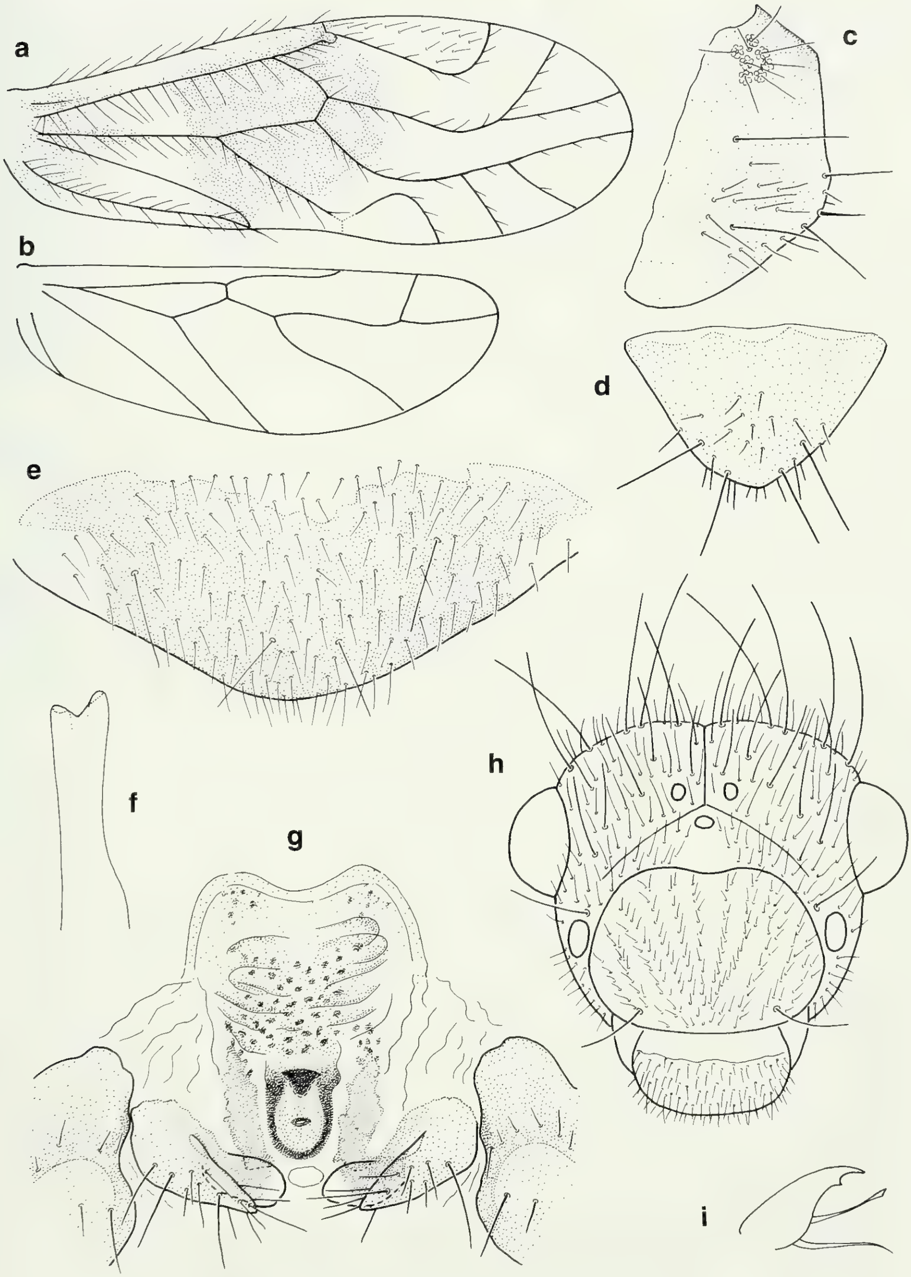

FIG. 3

Lachesilla hirsuta sp. n., female: **a**, forewing; **b**, hindwing; **c**, left paraproct; **d**, epiproct; **e**, subgenital plate; **f**, lacinial tip; **g**, gonapophyses and 9th sternum with spermapore; **h**, head, frontal view; **i**, pretarsal claw.

hairs on veins, sometimes two rows on *an*, *pcu* bare, pilosity particularly dense and long in basal half of wing, wing margin pilose between anterior wing base and pterostigma, otherwise bare, some hairs also on pterostigmal membrane. In forewing *rs* and *m* joined by a relatively long crossvein, *m* usually 3-branched (in left forewing of holotype only 2-branched). Hindwing glabrous, *rs* and *m* basally fused for a distance (fig. 3b).

Epiproct and paraprocts simple (fig. 3c, d), the latter bearing some trichobothria, lacking field of short stout setae along median margin in ventral half. Subgenital plate rounded posteriorly (fig. 3e). Gonapophyses (fig. 3g): two pairs of valvulae present, v2 smaller than v3, glabrous, v3 tapering to its apex, bearing about a dozen setae. 9th sternum with characteristic sclerotization around spermapore (fig. 3g).

Measurements (♀ holotype). BL = 2.0 mm; FW = 1.8 mm; A = 870 µm; F = 420 µm; T = 710 µm; t1 = 198 µm; t2 = 100 µm.

Remark. The male of this species is not yet known, but the presence of sperm in the spermatheca of the dissected holotype female gives evidence of the bisexuality of the species.

DISCUSSION

According to the generic diagnosis given by Garcia Aldrete (1974) and Mockford (1993) the new species belongs undoubtedly to the genus *Lachesilla*, if we leave the pilosity characters out of account. In *Lachesilla* the pilosity on head and mesonotum is well developed but much shorter and less dense than in the new species, without particularly long hairs (cf. for example, Garcia Aldrete, 1982b: fig. 21, 1988: fig. 2). Concerning wing pilosity in *Lachesilla*, Garcia Aldrete (1974: p. 8) writes: forewings "bearing minute hairs along veins and in the pterostigma; wing hairs generally not visible below 150x; wing margins bare". Therefore the general habitus of a *Lachesilla* species is that of a normally pilose psocid with practically bare wings, while *L. hirsuta* sp. n. remembers the habitus of a pseudocaeciliid, characterized by extensive pilosity on head, mesonotum and wings. Even in the few known *Lachesilla* species where forewing pilosity is slightly more developed, the hairs are always much shorter than in *L. hirsuta* (e. g. *L. palmicola*, cf. Garcia Aldrete, 1981: fig 3, or *L. marginata*, cf. New & Thornton, 1975: fig. 69).

In some other genera of Lachesillidae a more extensive pilosity of forewing veins, margin and sometimes membrane has been observed, e. g. *Nadleria* Badonnel & Garcia Aldrete (cf. Mockford, 1985: figs 7, 8) or *Tricholachesilla* Mockford & Sullivan (cf. Mockford & Sullivan, 1986: fig. 135). As in *L. hirsuta*, in these taxa the pilosity generally becomes sparser towards the apex of the wing. But based on general and genital morphology the new species has to be placed in *Lachesilla*, in spite of its unusual habitus. Due to the absence of males, it is difficult to place it in one of the species groups defined within *Lachesilla*. Probably *L. hirsuta* belongs to the *pedicularia* group as diagnosed by Garcia Aldrete (1974) and Mockford (1993). Usually the females of this species group have only one pair of gonapophyses (v3), but Garcia Aldrete (1974: p. 21 and figs 193, 194) mentions the presence of two pairs in some undescribed species (from Central Africa, Uganda, cf. Garcia Aldrete, *in litt.*).

Contrary to the preceding case of *Odontopsocus compactus*, we are not able to interprete the strongly developed pilosity observed in *Lachesilla hirsuta* as an adaptation to a particular mode of life. It is even difficult to establish the evolutionary polarity of this character. In the present case it could be considered as an apomorphic reversal after its gradual reduction to very short and sparse pilosity in most of the Lachesillidae. Within the family-group of the Homilopsocidea, to which the Lachesillidae belong, a well developed pilosity has undoubtedly to be considered as the plesiomorphic character state, observed in most members of several families (e. g. Pseudocaeciliidae, Trichopsocidae, Elipsocidae, Philotarsidae). Only future phylogenetic studies will show if, in *L. hirsuta*, we are in front of a symplesiomorphic resemblance to Pseudocaeciliidae, or if we have to interprete the situation as an autapomorphy of an isolated species within the genus *Lachesilla* (character reversal).

Ectopsocus venosus sp. n. Fig. 4

MATERIAL

Holotype ♀ (MHNG, slide no 7452). EAST MALAYSIA: SABAH: Kinabalu National Park, Mt Kinabalu, 1750 m, Liwagu Trail, beating vegetation, 27.IV.1987, leg. D. Burckhardt & I. Löbl.

DIAGNOSIS

Forewing with *rs* 5-branched and *m* 6-7-branched (fig. 4a, c).

DESCRIPTION (♀)

Coloration. Head and thorax yellowish brown, compound eyes black, antennae and legs light brown, abdomen yellowish (including terminalia), preclunial segments indistinctly annulated with some red-brown hypodermal pigment. Forewing (fig. 4a) slightly tawny, especially in basal and central cells; the following veins with cloudy brown borders: *sc* at base of pterostigma, connection point of *rs* and *m*, distal part of *r*1, branches of *rs* and *m* and distal part of *cu*; insertion points of hairs on veins surrounded by a cloudy brown spot. Hindwing clear (fig. 4b).

Morphology. Compound eyes relatively small (IO/D = 2.5), three ocelli present, but rather weakly developed. Lacinial tip as in fig. 4g. Pilosity of head, antennae and mesonotum well developed, typical for the family. Pretarsal claw with a broad membranous pulvillus, lacking preapical denticle, typical for the family. Pearman's organ on hind coxa weakly developed, only coxal rasp visible. Forewing (fig. 4a,c) with well visible pilosity on veins and margin, *pcu* bare; *rs* and *m* joined by a very short crossvein; *rs* 5-branched in both forewings of the holotype, in the right forewing all branches arising from one point (fig. 4a), in the left forewing (fig. 4c) two of them slightly stalked and arising basally from the first branch, the latter with an additional spur-vein near this bifurcation; *m* 6-branched in the right forewing (fig. 4a), 7-branched in the left forewing (fig. 4c). Venation normal in basal half of both forewings. Hindwing bare, with normal venation, *rs* and *m* joined by a long crossvein (fig. 4b).

Epiproct simple, with some long stout setae; paraprocts with 8 trichobothria, a median row of 5 long stout setae, a similar seta on hind margin and ventrally to it a

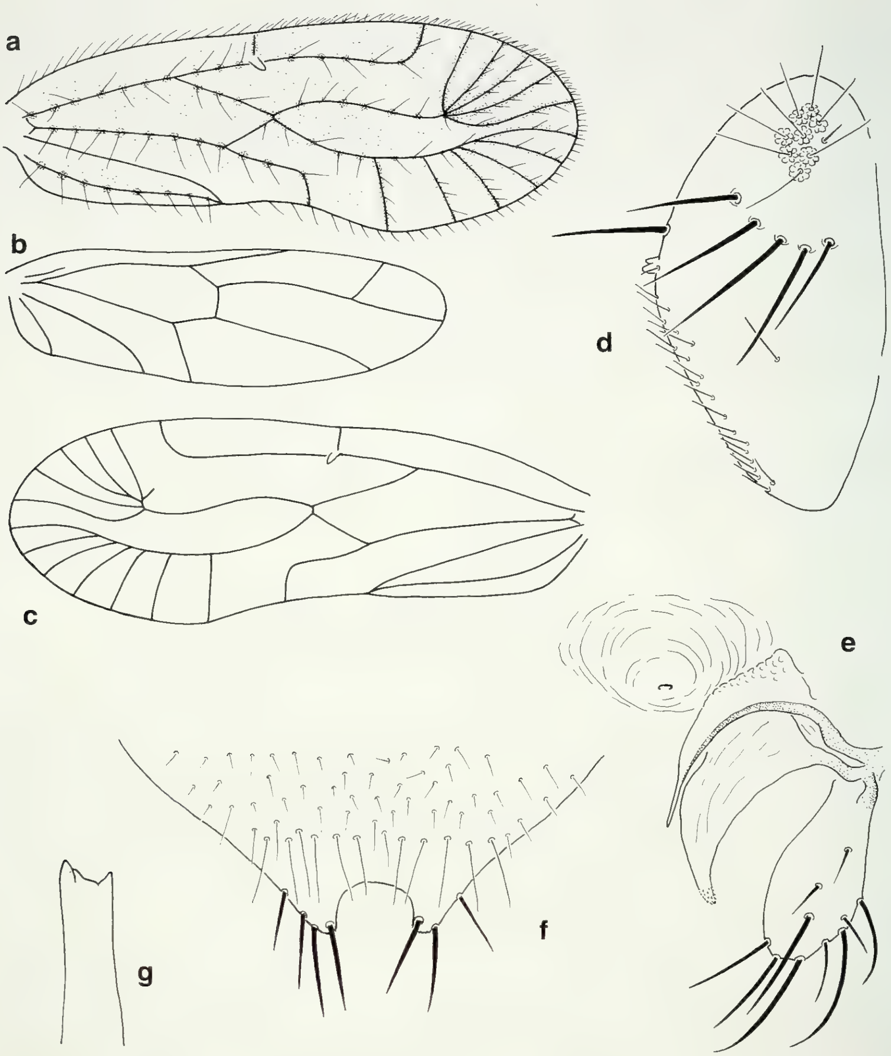

FIG. 4

Ectopsocus venosus sp. n., female: **a**, right forewing; **b**, right hindwing; **c**, left forewing (pilosity and pigmentation not shown); **d**, right paraproct; **e**, gonapophyses and spermapore; **f**, subgenital plate; **g**, lacinial tip.

marginal tubercle, simple on the left paraproct, bifid on the right one (fig. 4d), ventral half of paraprocts with a series of short marginal hairs. Subgenital plate (fig. 4f) apically bilobed, the relatively short lobes separated medially by a semicircular indentation, each lobe with 3-4 stout external and apical setae. Gonapophyses (fig. 4e): three pairs of valvulae present, v1 and v2 apically tapering, glabrous, v3 rounded, with some long setae on apical half. 9th sternum membranous, no sclerotization around spermapore (fig. 4e).

Measurements (♀ holotype). BL = 1.8 mm; FW = 2.1 mm; A = 1.7 mm; F = 480 µm; T = 720 µm; t1 = 235 µm; t2 = 100 µm.

Remark. The male of this species is not known.

DISCUSSION

In the forewing of Psocoptera and in particular of Ectopsocidae the veins *rs* and *m* are usually 2-branched and 3-branched respectively (cf. fig. 3a; in the following called standard venation). In a few cases this number of branches can be reduced (e. g. in the fully winged genus *Ypsiloneura* Pearman, family Caeciliusidae, cf. Pearman, 1932: fig. 1 or Badonnel, 1955: fig. 341), sometimes combined with a reduction of wing length (brachypterous forms of several genera). Multiplication of *rs* and *m* branches has hitherto been observed in some species of the families Epipsocidae, Ptiloneuridae, Amphipsocidae and Calopsocidae, belonging to three different family-groups (cf. figures in Smithers, 1990). In these families it is often not possible to consider the undoubtedly apomorphic multiplication of veins as a generic character, as it has been shown by Mockford (1998) and Casasola Gonzalez (2001) for the genus *Goja* Navas (Epipsocidae), which contains both, species with multiple veins *rs* and *m*, and species with standard venation. In many species of the above mentioned families, showing multiple branching of *rs* and *m*, some intraspecific variability and often some slight intraindividual dissymmetries can be observed (cf. Thornton & Smithers, 1984; Casasola Gonzalez, 2001). But never a similar case of multiple branching merely due to a teratological deformity has been described in a psocid genus with standard venation. In psocids, teratological aberrations of forewing venation are usually characterized by some omitted branches or one extra branch of *rs*, *m* or *cu* or some added crossveins, and they are usually strongly dissymmetric (cf. Clark, 1979). In view of these observations, we exclude here the eventuality of a teratological deformity for the new ectopsocid described above. Based on characters of general and genital morphology this species belongs to *Ectopsocus*, as diagnosed by Thornton & Wong (1968) and Mockford (1993). Due to the absence of males, the species cannot be placed in one of the species goups defined by Thornton & Wong (1968) for this genus.

There is no evident functional interpretation of the particular forewing morphology of *E. venosus*. Multiplication of veins in the apical part of the wing could result in an increase of mechanical stability. Might there be an evolutionary advantage of "wire-netting" the forewing apex, even in such a small species (wing length 2.1 mm) ? – In this context it is interesting to see that all other psocids with multiple veins are much larger, with forewings usually about twice as long as in *E. venosus*, up to more than 5 mm in *Goja*, for example (Casasola Gonzalez, 2001).

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REFERENCES

BADONNEL, A. 1931. Contribution à l'étude de la faune du Mozambique. Voyage de M. P. Lesne (1928-1929). 4e note. Copéognathes. *Annales des Sciences naturelles, Zoologie* (10)14(16): 229-260.

BADONNEL, A. 1955. Psocoptères de l'Angola. *Publicações culturais da Companhia de Diamantes de Angola* 26: 1-267.

BADONNEL, A. 1963. Sur le genre *Lesneia* Badonnel (Psocoptera), avec description d'une nouvelle espèce. *Archives de Zoologie expérimentale et générale* 102: 41-48.

BADONNEL, A. 1981. Psocoptères (Insecta: Psocoptera) de l'Inde. Mission Besuchet-Löbl (1978) et voyage entomologique Löbl 1979. *Revue suisse de Zoologie* 88: 381-411.

BADONNEL, A. 1987. Psocoptères de Venezuela et de la République Argentine. *In*: DECU, V. *et al.* Fauna hipogea y hemiedaphica de Venezuela y de otros paises de America del Sur. *Bucharest.* (Psoc.: vol. 1(17): 173-182).

BROADHEAD, E. & RICHARDS, A. M. 1982. The Psocoptera of East Africa - a taxonomic and ecological survey. *Biological Journal of the Linnean Society* 17: 137-216.

CASASOLA GONZALEZ, J. A. 2001. Revision taxonomica del genero *Goja* Navas (Psocoptera : Epipsocidae). *Doctoral thesis, Universidad Nacional Autonoma de Mexico, Facultad de Ciencias, Mexico,* 92 pp.

CLARK, J. T. 1979. Aberrant wing venation in twelve British species of Psocoptera. *Systematic Entomology* 4: 209-213.

GARCIA ALDRETE, A. N. 1974. A classification above species level of the genus *Lachesilla* Westwood (Psocoptera: Lachesillidae). *Folia Entomologica Mexicana* 27: 1-88.

GARCIA ALDRETE, A. N. 1981. The species group *palmicola* of the genus *Lachesilla* (Psocoptera: Lachesillidae). *Folia Entomologica Mexicana* 47: 25-35.

GARCIA ALDRETE, A. N. 1982a. Descripcion del macho de *Protroctopsocus enigmaticus* Mockford y registros de distribucion de la especie (Psocoptera: Troctopsocidae). *Anales del Instituto de Biologia, Universidad nacional autonoma de Mexico, Ser. Zool.* 52(1): 119-122.

GARCIA ALDRETE, A. N. 1982b. Descriptions of new *Lachesilla* species and description of the female *L. magnifica* Garcia Aldrete (Psocoptera: Lachesillidae). *Folia Entomologica Mexicana* 53: 43-65.

GARCIA ALDRETE, A. N. 1988. A new Oriental *Lachesilla* (Psocoptera: Lachesillidae). *Oriental Insects* 22: 501-504.

HICKMAN, V. V. 1934. A contribution to the study of Tasmanian Copeognatha. *Papers and Proceedings of the Royal Society of Tasmania* 1933: 77-89.

LIENHARD, C. 1998. Psocoptères euro-méditerranéens. *Faune de France* 83: XX+517 pp.

LIENHARD, C. & MOCKFORD, E. L. 1997. New taxa and records of Troctopsocidae (Psocoptera). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 70: 361-385.

MOCKFORD, E. L. 1967. The Electrentomoid psocids (Psocoptera). *Psyche* 74(2): 118-165.

MOCKFORD, E. L. 1985. Systematics of the genus *Nadleria* (Psocoptera: Lachesillidae) with description of a new species and hypotheses on evolution of male external genitalia in the family Lachesillidae. *Annals of the Entomological Society of America* 78(1): 94-100.

MOCKFORD, E. L. 1993. North American Psocoptera (Insecta). *Flora and Fauna Handbook* 10: XVIII+455 pp. *Sandhill Crane Press, Gainesville, Florida.*

MOCKFORD, E. L. 1996. New species and records of Psocoptera from northern Venezuela. *Tropical Zoology, Special Issue* 2: 1-98.

MOCKFORD, E. L. 1998. Generic definitions and species assignments in the family Epipsocidae (Psocoptera). *Insecta Mundi* 12 (1-2): 81-91.

MOCKFORD, E. L. & SULLIVAN, D. M. 1986. Systematics of the Graphocaeciliine psocids with a proposed higher classification of the family Lachesillidae (Psocoptera). *Transactions of the American Entomological Society* 112: 1-80.

New, T. R. 1987. Further Psocoptera from the Nepal Himalayas, collected by the Martens' expeditions (Insecta). *Courier des Forschungs-Institutes Senckenberg* 93: 353-358.

New, T. R. & Thornton, I. W. B. 1975. Psocomorpha (Psocoptera) collected on recent expeditions to South America. *Journal of Entomology* (B) 44(1): 27-80.

Pearman, J. V. 1932. Some coccophagous psocids (Psocoptera) from East Africa. *Stylops* 1(4): 90-96.

Smithers, C. N. 1984. The Psocoptera (Insecta) of South Australia. *Records of the South Australian Museum* 18(20): 453-491.

Smithers, C. N. 1990. Keys to the families and genera of Psocoptera (Arthropoda: Insecta). *Technical Reports of the Australian Museum* 2: 1-82.

Smithers, C. N. & Thornton, I. W. B. 1981. The Psocidae (Insecta: Psocoptera) of New Guinea, including a new coleopteriform genus from high on Mount Wilhelm. *Australian Journal of Zoology* 29: 921-969.

Thornton, I. W. B. & Smithers, C. N. 1984. Systematics of the Calopsocidae, an Oriental and Melanesian family of Psocoptera. *Systematic Entomology* 9(2): 183-244.

Thornton, I. W. B. & Wong, S. K. 1968. The Peripsocid fauna (Psocoptera) of the Oriental region and the Pacific. *Pacific Insects Monographs* 19: 1-158.

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Redescription of *Plagiophorus paradoxus* Motschulsky with comments on the pselaphine tribe Cyathigerini (Coleoptera: Staphylinidae)

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Redescription of *Plagiophorus paradoxus* Motschulsky with comments on the pselaphine tribe Cyathigerini (Coleoptera: Staphylinidae). - *Plagiophorus paradoxus* is redescribed based on the lectotype, which is designated here. *Plagiophorus* is transferred from the Batrisina to the Cyathigerini. The genera *Cyathiger* King, *Cyathigerodes* Jeannel, *Denicyathiger* Jeannel, *Manuleiger* Jeannel and *Paracyathiger* Jeannel are considered junior subjective synonyms of *Plagiophorus*, necessitating 83 new species combinations. *Plagiophorus raffrayi* (Bryant, 1915) and *P. raffrayi* (Leleup, 1974) become secondary homonyms, and a replacement name, *Plagiophorus cabindai,* is provided for the latter. *Plagiophorus inermis* Motschulsky is transferred to *Stipesa.*

Key-words: Coleoptera - Staphylinidae - Pselaphinae - Cyathigerini - *Plagiophorus* - taxonomy.

INTRODUCTION

Cyathigerine beetles live in leaf litter of humid forests in the Old World tropics. Currently some eighty species are described with about half of these being Oriental (including China and Japan), a third being Afrotropical, and the remainder being Australian (including New Guinea and the Solomon Islands). In Africa cyathigerines are relatively scarce and the described species (Leleup, 1974) probably constitute a reasonable representation of the existing fauna. A similar situation is found also in Australia (Chandler, 2001). However, in South and Southeast Asia (including New Guinea), these beetles are abundant, and the tribe is species-rich. They are encountered in a wide range of habitats, including strongly degraded sites. Based on collections made in Sri Lanka, India, Nepal, Thailand, West Malaysia, Borneo, Sumatra, Java and the Philippines (unpublished MHNG data), the Oriental fauna may contain ten times as many species as are currently known.

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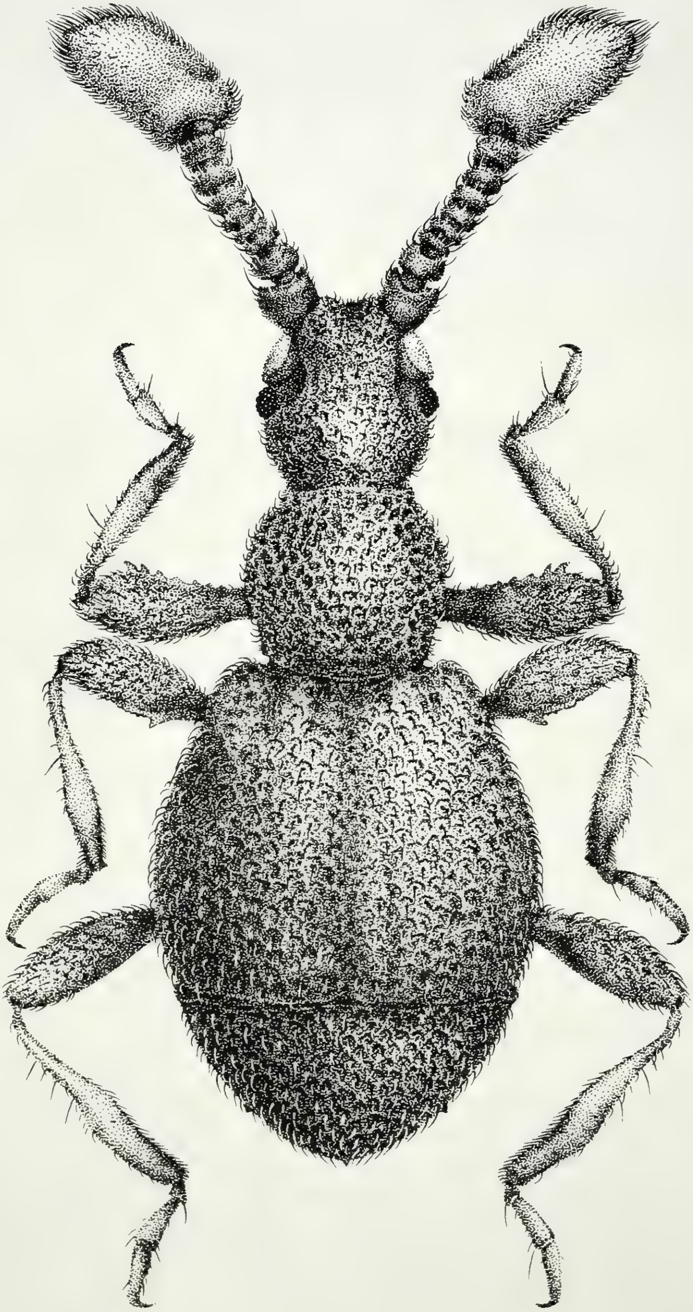


FIG. 1
Plagiophorus sp., from Sichuan (drawing by Nicolette Lavoyer).

The external morphology of cyathigerines is highly characteristic (fig. 1). Despite this relative uniformity, there are a wide array of details that may be used to define species. These details include general punctation and setosity, head, thorax and abdominal shape, number and shape of antennal segments, shape of maxillary palpi, size of eyes, etc. In addition to these there are often secondary sexual characters, particularly for males, on various parts of the body. The male aedeagus provides another set of characters for species recognition.

The tribe Cyathigerini was erected by Raffray (1890a) for the single genus *Cyathiger* King. Raffray suggested that the tribe is related to Goniacerini "at the very end of Brachyscelidae." This assignment was based on the trochanteral structure and the oblique insertion of the femora. Jeannel (1951) transferred the tribe to the macroscelids by alleging a close relationship to the Hybocephalini. This transfer was mostly based on superficial resemblance rather than genuine evidence. This fact was pointed out by Leleup (1974). Newton & Chandler (1989) and Nomura & Lee (1993) followed Jeannel (1951), but Chandler (2001) used Raffray's (1890a) classification.

Jeannel (1951, 1961) erected the genera *Cyathigerodes*, *Paracyathiger*, *Denicyathiger* and *Manuleiger* mostly on the basis of differences in the number of antennal segments and the shape of the antennal club. Burckhardt (1985) pointed out that the boundaries of Jeannel's genera had disappeared as additional species were added. He treated the group as the single genus *Cyathiger*, though without formally synonymysing Jeannel's genera.

Motschulsky (1851) erected the genus *Plagiophorus* for two species with a compact body form and a densely punctured body surface. One of the species was from "Indes orientales", for the other no provenance was noted. He placed the genus between *Tychus* and *Bythinus*. *P. paradoxus*, the second species, is described as being even more compact than *P. inermis*, and is said to bear a hammer-shaped antenna with an asymmetrically enlarged ultimate segment suggesting a resemblance, at least superficially, to members of the Cyathigerini. *Plagiophorus* was subsequently only mentioned in catalogues, e. g. as doubtful synonym of *Sathytes* Westwood, 1870, by Raffray (1904, 1908, 1911). Newton & Chandler (1989) designated *P. paradoxus* as type species and included *Plagiophorus* in the subtribe Batrisina.

In the present paper *Plagiophorus paradoxus* is redescribed based on the examination of type material, and the identity of *Plagiophorus* is discussed.

MATERIAL AND METHODS

The examined types of *Plagiophorus paradoxus* and *P. inermis* are deposited in the Zoological Museum of the University, Moscow (ZMUM). Identified and, to a larger extent, unidentified material in the collection of the Muséum d'histoire naturelle, Geneva (MHNG) forms the basis for assessing characters and their variation within the tribe Cyathigerini.

TAXONOMIC TREATMENT

Plagiophorus Motschulsky, 1851: 496.

Type species *Plagiophorus paradoxus* Motschulsky, by subsequent designation (Newton & Chandler, 1989: 39).

Cyathiger King, 1865: 174. Type species *Cyathiger punctatus* King, by monotypy. **Syn. n.**

Cyathigerodes Jeannel, 1951: 110. Type species *Cyathigerodes machadoi* Jeannel, by original designation. **Syn. n.**

Denicyathiger Jeannel, 1951: 109. Type species *Cyathiger bironis* Raffray, by original designation. **Syn. n.**

Paracyathiger Jeannel, 1951: 109. Type species *Cyathiger heterocerus* Raffray, by original designation. **Syn. n.**

Manuleiger Jeannel, 1961: 449. Type species *Manuleiger remyi* Jeannel, by original designation. **Syn. n.**

Plagiophorus paradoxus Motschulsky Figs 2-5

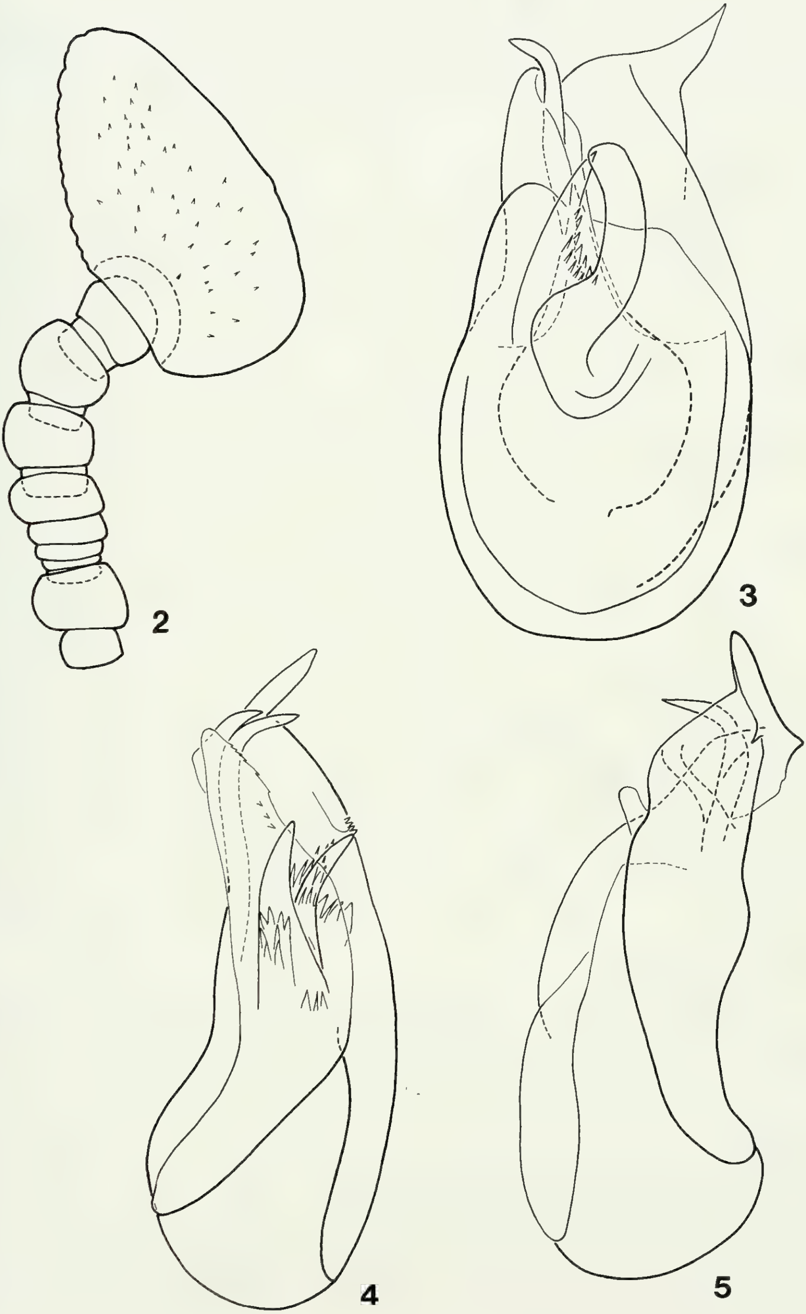
Plagiophorus paradoxus Motschulsky, 1851: 496. Lectotype ♂: "Indes orientales" (ZMUM), here designated (examined).

Description. Of Cyathigerini form as defined by Chandler (2001). Length 1.29 mm. Coarsely punctured, covered in short appressed setae.

Head including eyes wider than long (0.26/0.31 mm), wider than pronotum. Frontal lobe short and wide. Eyes very large. Ventral surface of head with small flat median denticle, indented on either side. Antenna (fig. 2) with 10 segments 7 of which are articulated; scape broad; pedicel slightly wider than long; segments 3 to 6 fused, segments still completely separated from each other but not articulate, length and width of segments increasing from 3 to 6; segments 7 to 9 subequal, about the same size as pedicel; segment 10 forming large asymmetrical club which is broadly irregularly rounded ventrally and strongly expanded dorsally, inner surface flattened, not modified. Apical segment of maxillary palpi relatively short, pear-shaped. Pronotum oval in dorsal view, longer than wide (0.39/0.30 mm). Wings developed. Abdominal sternite with deep basal cavity and shallow median depression which is delimited by a rounded bulge laterally and posteriorly; at base on either side with small denticle. Protibiae with subapical tooth on inner surface; legs otherwise simple.

Aedeagus (figs 3-5) 0.30 mm long, strongly asymmetrical. Dorsal window large, distinctly delimited. Parameres weakly sclerotised apically.

Comments. According to Motschulsky's (1851) original description, material of *Plagiophorus paradoxus* is in the "Museum of Prague, and the name was given by Mr Dornietzer" who was supposed to describe the species. No material could be traced in Prague (J. Jelínek, pers. comm.), and the species was never described by Dornietzer. There is only a single specimen in the ZMUM (C. Besuchet, pers. comm.) which is designated here as lectotype. This is to ensure stability in case the Dornietzer material turns up containing specimens which are not conspecific with the lectotype.



FIGS 2-5

Plagiophorus paradoxus Motschulsky, lectotype; 2: antenna (scape missing); 3-5: aedeagus in dorsal and lateral views.

Stipesa inermis (Motschulsky), comb. n.

Plagiophorus inermis Motschulsy, 1851: 496. Syntype: without locality (ZMUM), (examined).

Comments. The examination of the single syntype showed *P. inermis* to be a member of *Stipesa* Sharp, to which it is transferred here.

DISCUSSION

Examination of *P. paradoxus*, the type species of *Plagiophorus*, revealed that this taxon belongs to the Cyathigerini. In transferring *Plagiophorus* from its present position within the Batrisina to the Cyathigerini, the question arises concerning how it may be separated from the other five genera in the tribe (Newton & Chandler, 1989). Based on differences in the number of antennal segments, the shape of the frontal lobe of the head, the aedeagal structure, and possibly geographical considerations, Jeannel (1951) split *Cyathiger* King, 1865, into 4 genera: *Cyathiger*, *Cyathigerodes*, *Paracathiger* and *Denicyathiger*. Later Jeannel (1961) added *Manuleiger* from Sri Lanka. He did not discuss the phylogenetic significance of the characters which he used for his generic concepts, and his conclusions were derived from very limited material.

Burckhardt (1985) pointed out the artificial nature of Jeannel's genera. A large number of undescribed species from tropical Asia (MHNG data) blend Jeannel's characters used to characterize the five genera, and cannot be used to readily place species into Jeannel's genera. The artificial nature of these genera is illustrated also by the fact that three were monotypic in their original definition, one contained 2 species and one (*Paracyathiger*) embraced the remainder of species. Here we formally synonymise the cyathigerine genera with *Plagiophorus* (appendix 1) and propose 83 new combinations (appendix 2). This action creates following new secondary homonymy: *Plagiophorus raffrayi* (Bryant, 1915), comb. n. from *Cyathiger* and *Plagiophorus raffrayi* (Leleup, 1974), comb. n. from *Paracyathiger*. For the latter we propose the replacement name *Plagiophorus cabindai* nom. n.

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REFERENCES

Bryant, G. E. 1915. New species of *Cyathiger* (Fam. Pselaphidae) from Borneo and Penang. *Entomologist's monthly Magazine* 51: 249-256.

Burckhardt, D. 1985. Beitrag zur Kenntnis der Cyathigerini von Malaysia und Singapore (Coleoptera, Pselaphidae). *Revue suisse de Zoologie* 92: 255-270.

Burckhardt, D. 1988a. The genus *Cyathiger* King from the Solomon Islands (Coleoptera: Pselaphidae). *Mitteilungen der Schweizerischen entomologischen Gesellschaft* 61: 131-134.

Burckhardt, D. 1988b. On some Australian species of *Cyathiger* King (Coleoptera: Pselaphidae). *Revue suisse de Zoologie* 95: 385-390.

CHANDLER, D. S. 1986. A revision of the genus *Cyathiger* (Coleoptera: Pselaphidae). *Australian entomological Magazine* 12: 119-124.

CHANDLER, D. S. 2001. Biology, morphology, and systematics of the ant-like litter beetles of Australia (Coleoptera: Staphylinidae: Pselaphinae). *Memoirs on Entomology, International* 15, 560 pp.

JEANNEL, R. 1949. Psélaphides de la Côte d'Ivoire recueillis par MM. R. Paulian et Cl. Delamare-Deboutteville (1945). *Revue française d'Entomologie* 16: 99-127.

JEANNEL, R. 1951. Psélaphides de l'Angola (Coléoptères) recueillis par M. A. de Barros Machado. *Companhia de Diamantes de Angola (Diamang). Serviços Culturais, Publicaçoes Culturais* 9, 125 pp.

JEANNEL, R. 1952. Psélaphides recueillis par N. Leleup au Congo Belge IV. Faune de l'Itombwe et de la Forêt du Rugege. *Annales du Musée Royal du Congo Belge. Sciences Zoologiques* 11: 1-295.

JEANNEL, R. 1953 (1952). Psélaphides recueillis par N. Leleup au Congo Belge V. Faune de l'Itombwe-Sud, du Kahuzi, de la dorsale de Lubero et du Mont Hoyo. *Annales du Musée Royal du Congo Belge Sciences Zoologiques* 20: 1-313.

JEANNEL, R. 1954. Psélaphides recueillis par N. Leleup au Congo Belge sous les auspices de l'Institut pour la Recherche Scientifique en Afrique Centrale (I.R.S.A.C.) VI – XI. *Annales du Musée Royal du Congo Belge Siences Zoologiques* 33: 1-175.

JEANNEL, R. 1956. Psélaphides recueillis par N. Leleup au Congo Belge sous les auspices de l'Institut pour la Recherche Scientifique en Afrique Centrale (I.R.S.A.C.) XII – XV. *Annales du Musée Royal du Congo Belge Sciences Zoologiques* 43: 1-134.

JEANNEL, R. 1957. Sur quelques Psélaphides du Tonkin recueillis par le père A. de Cooman. *Revue française d'Entomologie* 24: 5-32.

JEANNEL, R. 1958. Révision des Psélaphides du Japon. *Mémoires du Muséum National d'Histoire Naturelle, Nouvelle Série, Série A, Zoologie*, 18: 1-138.

JEANNEL, R. 1959. Révision des Psélaphides de l'Afrique intertropicale. *Annales du Musée Royal du Congo Belge. Sciences Zoologiques* 75: 1-742.

JEANNEL, R. 1960. Psélaphides recueillis par N. Leleup au Congo Belge sous les auspices de l'Institut pour la Recherche Scientifique en Afrique Centrale (I.R.S.A.C.) XVI – XVIII. *Annales du Musée Royal du Congo Belge. Sciences Zoologiques* 83: 1-181.

JEANNEL, R. 1961. Sur les Psélaphides de Ceylan. *Bulletin of the British Museum (Natural History), Entomology* 10: 423-456.

KING, R. L. 1865. On the Pselaphidae of Australia. *Transactions of the entomological Society of New South Wales* 1: 167-175, pl. V.

KUBOTA, M: 1944. New and little known Pselaphidae from Japan. *Transactions of the Kansai entomological Society* 14: 6-11.

LEA, A. M. 1912. Australian and Tasmanian Coleoptera inhabiting or resorting to the nests of ants, bees and termites. Supplement. *Proceedings of the Royal Society of Victoria* 25: 31-78, pl. II.

LELEUP, N. 1974. Contribution à l'étude des Coléoptères Psélaphides de l'Afrique. 15. Révision et position systématique du genre *Cyathigerodes* Jeannel (Bythininae, Cyathigerini). *Revue de Zoologie africaine* 88: 625-673.

LELEUP, N. 1975. Contribution à l'étude des Coléoptères Psélaphides de l'Afrique 17. Deux *Cyathigerodes* anophtalmes nouveaux (Bythininae Cyathigerini). *Revue de Zoologie africaine* 89: 113-116.

LÖBL, I. 1964. Zwei neue Pselaphiden-Arten aus China (Coleoptera). *Reichenbachia* 67: 297-300.

MOTSCHULSKY, V. 1851. Énumération des nouvelles espèces de coléoptères rapportés par M. Victor Motschoulsky de son dernier voyage. *Bulletin de la Société Impériale des Naturalistes de Moscou* 24: 480-511.

NEWTON, A. F., Jr. & CHANDLER, D. S. 1989. World catalogue of the genera of Pselaphidae (Coleoptera). *Fieldiana*, Zoology, New Series 53, 93 pp.

NOMURA, S. & LEE, C. E. 1993. A revision of the family Pselaphidae (Coleoptera) from South Korea. *Esakia* 33: 1-48.

RAFFRAY, A. 1882. Psélaphides nouveaux ou peu connus. *Revue d'Entomologie, Caen* 1: 1-16.

RAFFRAY, A. 1890a. Études sur les Psélaphides. V. Tableaux synoptiques. Notes et synonymie. *Revue d'Entomologie, Caen* 9: 81-172.

RAFFRAY, A. 1890b. Études sur les Psélaphides. VI. Diagnoses des espèces nouvelles sur lesquelles sont fondés des genres nouveaux. *Revue d'Entomologie, Caen* 9: 193-219, pls II, III.

RAFFRAY, A. 1893 (1892). Révision des Psélaphides de Sumatra. *Annales de la Société entomologique de France* 61: 463-504, pl. 10.

RAFFRAY, A. 1895. Révision des Psélaphides des îles de Singapore et de Penang. *Revue d'Entomologie, Caen* 14: 21-82.

RAFFRAY, A. 1903. Voyage de M. L. Biró dans les possessions allemandes de la Nouvelle-Guinée. Psélaphides. *Annales historico-naturales Musei nationalis Hungariae* 1: 29-101, 2 pls.

RAFFRAY, A. 1904. Genera et catalogue des Psélaphides. *Annales de la Société entomologique de France* 73: 1-400.

RAFFRAY, A. 1908. Coleoptera. Fam. Pselaphidae. *In* Wytsmann, P. (ed.) Genera Insectorum 64, 487 pp., 9 pls.

RAFFRAY, A. 1911. *Pselaphidae. In* Schenkling S. (ed.) Coleopterorum Catalogus, pars 27. W. Junk, Berlin, 222 pp.

REITTER, E. 1883. Beitrag zur Pselaphiden- und Scydmaeniden-Fauna von Java und Borneo. *Verhandlungen der zoologisch-botanischen Gesellschaft, Wien* 33: 387-428, pl. XX.

REITTER, E. 1889. Note II. Neue Coleopteren aus dem Leydener Museum. *Notes from the Leyden Museum* 9: 3-9.

SCHAUFUSS, L. W. 1886. Beschreibung neuer Pselaphiden aus der Sammlung des Museums Ludwig Salvator. Ein Beitrag zur Fauna Brasiliens, der Kgl. Niederländischen Besitzungen in Indien und Neuhollands. *Tijdschrift voor Entomologie* 29: 241-296, pls 10-11.

APPENDIX. List of currently known *Plagiophorus* spp. with original combination (OC), additional combinations (AC), synonyms (SY) and known distribution (DI).

Plagiophorus allaeri (Leleup, 1974: 644), comb. n. OC *Cyathigerodes*; DI Gabon
Plagiophorus basilewskyi (Leleup, 1974: 645), comb. n. OC Cyathigerodes; DI Congo
Plagiophorus baumeisteri (Reitter, 1883: 388), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus bellendeni (Burckhardt, 1988a: 386), comb. n. OC *Cyathiger*; DI Australia
Plagiophorus besucheti (Burckhardt, 1985: 266), comb. n. OC *Cyathiger*; DI West Malaysia
Plagiophorus bironis (Raffray, 1903: 91), comb. n. OC *Cyathiger*; AC *Denicyathiger*; DI New Guinea
Plagiophorus bonsae (Leleup, 1974: 664), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus borneensis (Raffray, 1895: 55), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus bruynooghei (Leleup, 1974: 662), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus bulbifer (Bryant, 1915: 254), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus cabindai **nomen n.** for *Plagiophorus raffrayi* (Leleup, 1974: 642), comb. n. junior secondary homonym of *Plagiophorus raffrayi* (Bryant, 1915). OC *Cyathigerodes*; DI (Angola)
Plagiophorus caecus (Leleup, 1975: 116), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus celisi (Leleup, 1974: 654), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus cochlearius (Jeannel, 1953: 293), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus coiffaiti (Leleup, 1974: 666), comb. n. OC *Cyathigerodes*; DI Gabon
Plagiophorus coomani (Jeannel, 1957: 26), comb. n. OC *Paracyathiger*; DI Vietnam

Plagiophorus cribratus (Raffray, 1895: 58), comb. n. OC *Cyathiger*; AC *Paracyathiger*; DI Penang
Plagiophorus debeckeri (Leleup, 1974: 652), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus decamerus (Burckhardt, 1985: 258), comb. n. OC *Cyathiger*; DI Singapore
Plagiophorus decellei (Leleup, 1974: 647), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus delamarei (Jeannel, 1949: 112), comb. n. OC *Cyathiger*; AC *Cyathigerodes*; DI Ivory Coast
Plagiophorus denticornis (Leleup, 1974: 658), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus dispar (Bryant, 1915: 251), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus elongatus (Bryant, 1915: 252), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus endecamerus (Burckhardt, 1985: 256), comb. n. OC *Cyathiger*; DI West Malaysia
Plagiophorus fageli (Leleup, 1974: 658), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus feminatus (Leleup, 1974: 671), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus fujiyamai (Kubota, 1944: 7), comb. n. OC *Cyathiger*; AC *Paracyathiger*, Jeannel, 1958: 111; DI Japan, South Korea, China
Plagiophorus gibbicollis (Raffray, 1903: 89), comb. n. OC *Cyathiger*; DI New Guinea
Plagiophorus globosus (Jeannel, 1952: 273), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus gracilis (Raffray, 1904: 305), comb. n. OC *Cyathiger*; DI Sumatra
Plagiophorus grandiceps (Jeannel, 1959: 591), comb. n. OC *Cyathigerodes*; DI Tanzania
Plagiophorus heterocerus (Raffray, 1895: 53), comb. n. OC *Cyathiger*; AC *Paracyathiger* DI Singapore
Plagiophorus impar (Raffray, 1890b: 209), comb. n. OC *Cyathiger*; DI Penang
Plagiophorus inexspectus (Raffray, 1895: 56), comb. n. OC *Cyathiger*; DI Singapore
Plagiophorus infossus (Raffray, 1903: 90), comb. n. OC *Cyathiger*; AC *Paracyathiger*; DI New Guinea
Plagiophorus iturianus (Jeannel, 1953: 294), comb. n. OC *Cyathigerodes*; SY *Cyathigerodes globosus iturianus*, specific status attributed by Leleup, 1974: 669; DI Congo
Plagiophorus jeanneli (Leleup, 1974: 656), comb. n. OC *Cyathigerodes*; DI Ghana
Plagiophorus joannae (Jeannel, 1960: 168), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus juvencus (Reitter, 1889: 4), comb. n. OC *Cyathiger*; DI Sumatra
Plagiophorus kaszabi (Leleup, 1974: 654), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus kingi (Chandler, 1986: 122), comb. n. OC *Cyathiger*; DI Australia
Plagiophorus latipennis (Jeannel, 1954: 32), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus leai (Chandler, 1986: 121), comb. n. OC *Cyathiger*; DI Australia
Plagiophorus lejeunei (Leleup, 1974: 645), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus leleupi (Jeannel, 1952: 274), comb. n. OC *Cyathigerodes*; SY *Cyathigerodes parvicollis* Jeannel, 1952: 275, synonymised by Leleup, 1974: 648; DI Congo
Plagiophorus machadoi (Jeannel, 1951: 111), comb. n. OC *Cyathigerodes*; DI Angola
Plagiophorus magnicornis (Burckhardt, 1985: 265), comb. n. OC *Cyathiger*; DI West Malaysia
Plagiophorus malayanus (Bryant, 1915: 255), comb. n. OC *Cyathiger*; DI Penang
Plagiophorus matangensis (Bryant, 1915: 253), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus matousheki (Löbl, 1964: 297), comb. n. OC *Paracyathiger*; DI China, Japan
Plagiophorus minutissimus (Leleup, 1974: 652), comb. n. OC *Cyathigerodes*; DI Gabon
Plagiophorus mirandus (Bryant, 1915: 250), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus murphyi (Burckhardt, 1985: 259), comb. n. OC *Cyathiger*; DI Singapore
Plagiophorus myrmecophilus (Bryant, 1915: 250), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus nodicornis (Raffray, 1904: 306), comb. n. OC *Cyathiger*; DI Sumatra
Plagiophorus octomerus (Burckhardt, 1985: 260), comb. n. OC *Cyathiger*; DI West Malaysia
Plagiophorus pallidus (Raffray, 1893: 496), comb. n. OC *Cyathiger*; DI Sumatra
Plagiophorus paludicola (Jeannel, 1952: 274), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus paradoxus Motschulsky, 1851: 496. DI "Indes orientales"
Plagiophorus patruelis (Raffray, 1904: 306), comb. n. OC *Cyathiger*; DI Sumatra
Plagiophorus penangensis (Burckhardt, 1985: 269), comb. n. OC *Cyathiger*; DI West Malaysia
Plagiophorus pseudoheptamerus (Burckhardt, 1985: 268), comb. n. OC *Cyathiger*; DI Singapore

Plagiophorus punctatus (King, 1865: 174), comb. n. OC *Cyathiger*; SY *Cyathiger reitteri* Schaufuss, 1886: 242, synonymised by Raffray, 1904: 308; DI Australia
Plagiophorus raffrayi (Bryant, 1915: 255), comb. n. OC *Cyathiger*; DI Penang
Plagiophorus remyi (Jeannel, 1961: 450), comb. n. OC *Manuleiger*; DI Sri Lanka
Plagiophorus rufus (Raffray, 1895: 54), comb. n. OC *Cyathiger*; DI Singapore
Plagiophorus ruwenzoricus (Leleup, 1975: 114), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus sarawakensis (Bryant, 1915: 253), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus scabriusculus (Jeannel, 1960: 169), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus schaufussi (Reitter, 1883: 389), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus sericeus (Raffray, 1895: 57), comb. n. OC *Cyathiger*; DI Penang
Plagiophorus similis (Raffray, 1895: 60), comb. n. OC *Cyathiger*; DI Sumatra
Plagiophorus simonis (Reitter, 1883: 387), comb. n. OC *Cyathiger*; DI Borneo
Plagiophorus simulator (Lea, 1912: 49), comb. n. OC *Cyathiger*; DI Australia
Plagiophorus solomonensis (Burckhardt, 1988b: 131), comb. n. OC *Cyathiger*; DI Solomon Islands
Plagiophorus sylvestris (Raffray, 1882: 4), comb. n. OC *Cyathiger*; DI New Guinea
Plagiophorus transversestrigosus (Jeannel, 1956: 91), comb. n. OC *Cyathigerodes*; DI Congo
Plagiophorus truncatus (Raffray, 1904: 307), comb. n. OC *Cyathiger*; DI Sumatra
Plagiophorus variolosus (Raffray, 1895: 53), comb. n. OC *Cyathiger*; DI Penang
Plagiophorus vicinus (Burckhardt, 1985: 264), comb. n. OC *Cyathiger*; DI West Malaysia
Plagiophorus viduus (Raffray, 1895: 57), comb. n. OC *Cyathiger*; AC *Paracyathiger*; DI Singapore
Plagiophorus villiersi (Leleup, 1974: 642), comb. n. OC *Cyathigerodes*; DI Angola
Plagiophorus zicsii (Leleup, 1974: 653), comb. n. OC *Cyathigerodes*; DI Congo

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A revision of the *Herina lugubris* species group (Diptera, Ulidiidae, Otitinae), with the description of two new species

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A revision of the *Herina lugubris* species group (Diptera, Ulidiidae, Otitinae), with the description of two new species. - The *Herina lugubris* species group includes five externally almost indistinguishable species that may be separated unambiguously only by the structure of the male and female terminalia and, at least partly, by their distribution. *Herina aartseni* sp. n. is described from Bulgaria, Greece, Turkey, Cyprus and Israel. It is the sister species of *Herina rivosecchii* sp. n. (= *H. lugubris* auctt. nec Meigen), which is known from Central Europe and the Central Mediterranean region. The other three species of this group are *Herina lacustris* (Meigen) (= *H. approximata* (Villeneuve), syn. n.) from the Western Mediterranean region, *Herina ghilianii* (Rondani) from North Africa, Sicily and Malta and *Herina lugubris* (Meigen) (= *H. longistylata* Rivosecchi, syn. n.) from Italy, Southern France and Spain. The synonymy of *Ortalis lugens* Meigen with *O. lugubris* Meigen is confirmed by the study of the types. Detailed illustrations and a key to all species are given. A cladistic analysis of the species group is presented.

Key-words: Diptera - Ulidiidae - *Herina lugubris* species group - new species - phylogeny.

INTRODUCTION

Herina Robineau-Desvoidy as currently interpreted is a large and widespread genus of Ulidiidae which is known from the Palaearctic, Oriental, Australasian, Nearctic, and Neotropical regions. So far, some 35 species have been described (Kameneva, 2000).

The genus is best studied for the Western Palaearctic region where 14 species are recorded. Most species are known from the temperate part of the region, with a clear decline in diversity towards the Mediterranean region and the northern parts. An illustrated key and descriptions to all Palaearctic species were given by Kameneva (2000). Other useful keys were published by Hennig (1939), Rivosecchi (1995), Merz (1996), and Clements & Merz (1998).

Most Western Palaearctic species may be recognized by external characters (wing pattern, colouration of body), but a group of species is clearly separable only by the study of the terminalia of both sexes. The first species known in that group were

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Ortalis lugens, *O. lugubris* and *O. lacustris*, described by Meigen (1826). Later, Rondani (1869) described a similar species from Sicily and Malta (*H. ghilianii*), and Villeneuve (1921) another species from Tunisia (*H. nigrina* var. *approximata*). Recently, Rivosecchi (1992) described *H. longistylata* from Italy, which differs in the male terminalia from the illustrations of *H. lugubris* given in Hennig (1939).

While studying a large number of specimens of *Herina* from various parts of the Mediterranean region, it became apparent that another yet undescribed species exists in this group. The discovery of this species, which differs from the existing species in characters of the genitalia in both sexes, prompted a revision of the entire species group, defining its limits and discussing its phylogeny.

MATERIAL AND METHODS

The specimens on which this study is based are deposited in the following collections:

CBM	private collection B. Merz, Genève, Switzerland
CBVA	private collection Bob van Aartsen, t'Harde, Netherlands
CGB	private collection Gerhard Bächli, Zürich, Switzerland
CLR	private collection Leo Rivosecchi, Roma, Italy
CMCT	private collection Miguel Carles-Tolrà, Barcelona, Spain
CME	private collection Martin Ebejer, Balzan, Malta
CPG	private collection Martin Gatt, Rabat, Malta
HNHM	Hungarian Natural History Museum, Budapest, Hungary (L. Papp)
MHNG	Muséum d'histoire naturelle, Genève, Switzerland
MHNN	Muséum d'histoire naturelle, Neuchâtel, Switzerland (J.-P. Haenni)
MZLS	Museo Zoologico “La Specola”, Firenze, Italy (S. Whitman)
MNHNP	Muséum National d'Histoire Naturelle, Paris, France (J. Charbonnel)
NHMW	Naturhistorisches Museum Wien, Austria (R. Contreras-Lichtenberg)
RMNH	National Natuurhistorisch Museum, Leiden, Netherlands (C. van Achterberg)
TAU	Tel Aviv University, Israel (A. Freidberg)
USNM	United States Natural History Museum, Washington D. C., USA (A. L. Norrbom)
ZMB	Zoological Museum of Bergen, Norway (L. Greve-Jensen)

The terminology used here follows Papp & Darvas (2000) except for terms of the antennae, which are applied according to Stuckenberg (1999). Labels of examined primary types are cited strictly in verbatim.

THE *HERINA LUGUBRIS* SPECIES GROUP

Diagnosis

The species of this group may be recognized by the following set of characters: head in profile high and narrow (Fig. 1); frons, face and antennae brownish yellow with the postpedicel about 2.5 times as long as wide (Fig. 2); scutum subshining black; wing with complete discal band and with a distinctive hook-like apical band which is separated from the wing tip (Figs 4-5) or which is weaker at the wing tip (Fig. 6); abdominal tergite 3 at base with grey stripe (Fig. 3); male surstylus apically forked and with two black, conspicuous spines. Relationships and separation from other species are presented below in the key and phylogenetic discussion.

DESCRIPTION

Head (Fig. 1) bicoloured: frons and face brownish yellow; occiput, ocellar triangle, posterior quarter of fronto-orbital plate and postgena blackish; anterior three quarter of fronto-orbital plate and parafacial yellow with very dense silvery microtrichosity; antennae yellow, but postpedicel dorsally and in apical half to various degree darkened (Fig. 2); palpus yellowish, prementum shining black. Head in profile 1.5 times as high as wide, gena about one quarter to one fifth as high as the compound eye; frons densely black setulose in anterior three quarters; lunule with 1 black seta, sometimes with additional 1-2 smaller setulae; fronto-orbital plate with 1 row of laterally directed black setulae in anterior three quarters; face with a broad and shallow median carina; occiput almost flat, Antennae with scape and pedicel black setulose, pedicel with one dorsal seta; postpedicel about 2.5 times as long as wide, and about 3 times as long as pedicel, dorso-apically slightly pointed; arista yellow at base, remaining flagellum blackish, almost bare. Mouthparts not projecting beyond oral opening; palpi sparsely setulose; proboscis capitate. The following paired, black setae are present: 2 reclinate fronto-orbital setae on posterior quarter of fronto-orbital plate, of which the anterior seta is less than half as long as posterior seta; 1 short, laterally directed ocellar seta; 1 longer lateral and a shorter medial vertical seta; 1 short, slightly eclinate postocellar seta which lies on the level of the lateral vertical seta; 1 regular row of short postocular setae, and some irregular rows posteriorly on occiput.

Thorax entirely subshining black, covered with a rather thin layer of microtrichosity which does not obscure entirely the underlying cuticule; scutum with about 8 more or less regular rows of short acrostichal setulae between the dorsocentral setae; prosternum with one soft seta; proepisternum with 3-4 stiffy, black setulae; anepisternum and katepisternum covered with setulae, anepimeron bare. Chaetotaxy: 1 postpronotal seta; 2 notopleural setae; 2 supraalar setae, of which the anterior, shorter seta is inserted on line of posterior notopleural seta; 2 postalar setae, 1 dorsocentral seta posterior of level of anterior base of wing; 1 long prescutellar seta; 2 strong scutellar setae; 1 strong proepisternal seta just above anterior coxa; 1 strong and 1-2 weaker anepisternal setae at posterior margin; 1 katepisternal seta. Halter yellow.

Legs black, but knees, anterior basitarsus and posterior two pairs of tarsi to various degree yellowish; specimens in alcohol are much paler; anterior femur with a row of anterodorsal and a row of posterodorsal setae; mid tibia dorsally with 1 short, black subapical and ventrally with 2 black apical setae; hind femur dorsally near apex with 1-2 outstanding setulae.

Wing (Figs 4-6) with bare veins except for apical half of R_1 dorsally which is setulose; cell cup with short extension; distance between crossveins R-M and DM-Cu variable. Dark brown pattern consists of 4 areas: basal area covers the basal costal cells and may reach to vein M_{1+2}; discal area separated or connected to basal area, consisting of an uninterrupted, more or less parallel crossband from pterostigma through R-M; the preapical crossband covers the DM-Cu crossvein and is usually isolated from other dark areas; the apical area is always isolated, and covers the apex of cell r_1 and penetrates as a more or less parallel crossband into cell r_{4+5} or m_{1+2}; usually leaving the apex of the wing hyaline, except for *H. lacustris*. Squamae little developed, white-yellow.

Abdomen (Fig. 3) shining black in ground colour with very thin microtrichosity; tergite 3 always at anterior margin with a contrasting, silvery-grey band; whole abdomen setulose without major setae.

Male terminalia (Figs 7-25) with a large cercus, a bulbous, shining black epandrium and modified surstyli; internal genitals (hypandrium, gonites, aedeagus) as in other species of the genus. Cercus of various form, arrow-shaped to broadly triangular, either almost membranous or apically sclerotized. Surstylus in profile more or less parallel-sided, usually curved anteriorly towards tip; divided apically into two branches; lateral branch usually longer and narrower (except for *H. lugubris*), curved medially, evenly rounded at tip or with an apical tooth; medial branch flattened, broad, apically pointed or flat, with a series of setulae on inner side; two black spines either on each branch of surstylus or in depression between them.

Female terminalia (Figs 26-37) with a shining black, short oviscape, a strongly rugulose eversible membrane and a sclerotized aculeus. At tip of sternite 8 with or without internal sclerotization; apical cercus elongated, with 1 long dorsal seta and 3 long and 2 short ventral setae, either clearly separated from remaining aculeus by a constriction or almost continuous with it; ventral plate of cercus either straight or with sinuate margin. 3 spermathecae present, the single spermatheca is slightly longer.

KEY TO THE SPECIES OF THE *HERINA LUGUBRIS* SPECIES GROUP

1 Wing with 4 dark areas (Figs 4-6) with the basal and discal area connected (Fig. 6) or separated (Figs 4-5); discal crossband usually uninterrupted between C and R-M; abdominal tergite 3 at base with grey stripe (Fig. 3). Male: surstylus divided apically into two branches, and 2 black spines present on or near branches (Figs 7-8) . . . . (*H. lugubris* species group) 2

- Wing pattern usually less extensive, dark area of pterostigma separated from dark border around R-M; if an uninterrupted dark crossband present between pterostigma and R-M, then at the same time with a large dark area at wing tip and crossveins separated by distance longer than length of DM-Cu; abdominal tergite 3 usually unicolourous. Male: shape of surstylus and position of spines variable . . . . . other species of *Herina*

2 Wing (Fig. 6): Basal and discal dark area forming a continuous band to tip of pterostigma; R-M and DM-Cu crossveins approximated, their distance less than length of DM-Cu; tergite 3 usually with a narrow grey parallel stripe along anterior margin (less pronounced than in Fig. 3). Male: surstylus and cercus as in Figs 14-17. Female: terminalia as in Figs 32-33 . . . . *H. lacustris* (Meigen)

- Wings (Figs 4-5): Basal and discal areas clearly separated from each other in basal half of pterostigma; R-M and DM-Cu crossveins separated by at least length of DM-Cu; grey stripe on anterior margin of tergite 3 somewhat larger in the middle (Fig. 3). Male and female terminalia different 3

3 Male: both black spines on surstylus clearly separated from each other; medial branch of surstylus broad, thumb-like, pointed at apex (Figs 7-8). Female: between cerci and tip of sternite 8 internally with a single or paired sclerotization (Figs 27, 31); sternite 8 comparatively short, not longer than two third as long as the entire aculeus 4

- Male: both black spines on surstylus close-set, lateral spine only visible under certain angle (Figs 11, 20). Female: no internal sclerotization present between cerci and tip of sternite 8 (Figs 32-37); sternite 8 elongated, longer than three quarter the length of the entire aculeus 5

4 Male: Medial dark spine of surstylus simple (Fig. 25); lateral spine near tip of its branch; lateral branch pointed at tip (Figs 22-23); cerci triangular, with well visible paired sclerotization at tip (Fig. 22). Female: Cerci at base narrower than tip of sternite 8 (Fig. 30); cerci clearly separated from remaining aculeus by a constriction (Fig. 31); internal scerotisation at tip of sternite 8 unpaired, rather large (Fig. 31) .... *H. rivosecchii* sp. n.

- Male: Medial dark spine of surstylus with lateral process (Fig. 10); lateral spine near base of its branch; lateral branch with a finger-like projection at tip (Figs 7-8); cerci ovoid, without distinct sclerotization (Fig. 7). Female: Cerci broad, basally almost as broad as tip of sternite 8 at tip (Fig. 26); aculeus evenly narrowed towards tip, without constriction between sternite 8 and cerci (Figs 27-28); internal sclerotization at tip of sternite 8 paired, small (Fig. 27) .... *H. aartseni* sp. n.

5 Wing with a short apical crossband, reaching only middle of cell r_{4+5} (as in Fig. 4), except for some populations from Great Britain which have an elongated apical crossband as in Fig. 5. Male: medial branch of surstylus much larger and longer than lateral branch; cerci arrow-shaped, longer than wide (Fig. 18-19). Female: Aculeus long and narrow, evenly pointed (Fig. 34); sternite 8 ventrally rippled at tip (Fig. 35) .... *H. lugubris* (Meigen)

- Wing with long apical crossband always penetrating into cell m_{1+2} (Fig. 5). Male: medial branch of surstylus truncate, shorter than lateral branch; cerci plate-like, about as long as broad (Figs 11-12). Female: Aculeus broader; sternite 8 ventrally at tip only indistinctly rugulose, more or less smooth (Figs 36-37) .... *H. ghilianii* Rondani

TREATMENT OF THE SPECIES OF THE *HERINA LUGUBRIS* GROUP

Herina aartseni sp. n. Figs 1-4, 7-10, 26-29

Herina lugubris sensu Hennig, 1939, Fig. 14, nec Meigen, 1826.

MATERIAL (90♂♂, 89♀♀)

Holotype ♂. **[Bulgaria]**: "E Bulgaria (Mal. tr. 3) / Sv. Vlas, near Nesebar / c. 20m, 1-31.VIII.1998 / C. v. Achterberg, R. de Vries / P. V. Atanassova, RMNH 99", "Holotypus", "*Herina / aartseni* n. sp. ♂ / det. B. Merz" (RMNH). The specimen is laterally glued on a triangular card and is in excellent condition.

Paratypes: **Bulgaria**, same locality as holotype, but following dates: 1♂, 2♀♀, 8.-31.V.1998; 5♂♂, 8♀♀, 1.-30.VI.1998; 15♂♂, 13♀♀, 1.-31.VII.1998; 5♂♂, 11♀♀, 1.-31.VIII.1998; 4♀♀, 1.-30.IX.1998; 4♂♂, 4♀♀, NW Bulgaria (Mal. tr. 4), Zelin, near Botevgrad, c. 500m, 9.VI.-5.VII.1998, same collectors; 1♂, SW Bulgaria (Mal. tr. 6), Melnik, near Petric, c. 450m, 11.V.-12.VI.1998, same collectors (CBM, CBVA, CLR, CME, CPG, HNHM, MHNG, NHMW, RMNH, USNM). **Cyprus**, 1♂, 6km Z. v. Kyrenia, 300m, 15.VI. 1971, leg. M.J. & J.P. Duffels (MHNG). **Greece**: 1♂, Skiathos, nr. Troulos, 9.X.1996, leg. L. Greve (ZMB). 1♀, Ionic islands, Levkas, Metachorion, 11.IX.1984, leg. M. Revier (MHNG). **Israel**: 1♂, Nahal Bezet, 30.VIII.1984, leg. A. Freidberg (TAU); 4♂♂, 2♀♀, Majdel Chams, 14.X.1982, leg. A. Zadka (TAU); 4♀♀, Majdel Chams, 14.X.1982, leg. F. Kaplan (TAU); 17♂♂, 9♀♀, Majdel Chams, 14.X.1982, leg. A. Freidberg (MHNG, TAU); 2♂♂, 1♀, Majdel Chams, 14.X.1982, leg. Y. Zvik (TAU); 1♀, Majdal Shams Spring, 17.VI.1999, leg. A. Friedman (TAU); 1♀, Carmel, 26.IX.1970, leg. A. Freidberg (TAU); 6♂♂, 3♀♀, Carmel, 30.VIII.1978, leg. A. Freidberg (TAU); 2♂♂, 3♀♀, Carmel, 9.IX.1978, leg. A. Freidberg (TAU); 1♀, Carmel, 1.X.197 [sic] (TAU); 1♂, 1♀, Karmel, 6.XI.1977, leg. Valdenberg (TAU); 1♀. Karmel, X.1982, leg. A. Valdenberg (TAU); 13♂♂, 7♀♀, Golan, Spring nr. Nahal Nimrod, 30.X.1985, leg. A. Freidberg (CBM, TAU); 1♂, 2♀♀, Nimrod Springs, 1000m, 6.VIII.1986, leg. A. Freidberg (MHNG, TAU); 1♀, Nahal Nimrod, 1000m, 3.VIII. 1995, leg. A. Freidberg (TAU). **Turkey**: 1♂, Yazir, 800m, 22.-27.VII.1997, leg. R. Allemand (CBM); 1♀, Karaovabeli G., 22.-27.VII.1997, leg. R. Allemand (CGB); 4♂♂, 2♀♀, Isparta, Korada, stream, oak and *Platanus* woods, 7.VII.1997, leg. M. J. Ebejer (CME); 1♀, same data, but leg P. Gatt (CPG); 1♂, 1♀, Izmir, Kemalpasa, 600m, forest: oak, pine, 10.VII.1997, leg. M. J. Ebejer (CME); 1♂, 4♀♀, same data, but leg. P. Gatt (CPG); 1♂, Mugla, Marmaris, stream, pine woods, 400m, 14.VII.1997, leg. M. J. Ebejer (CME); 1♂, 1♀, same data, but leg. P. Gatt (CPG).

ETYMOLOGY

Named in honour of Bob van Aartsen, t'Harde, who put most of the type series at my disposal and in recognition for his outstanding work in dipterology.

DIAGNOSIS

This species is characterised in the male by the presence of a black spine at the base of the lateral branch of the surstylus (Fig. 7) and by the irregularly shaped black spine on the medial branch of the surstylus (Fig. 10); the lateral branch is curved for more than 90°, thus the internal angle is acute; its tip shows a tooth-like projection ventrally; the cercus is ovoid and only weakly sclerotized. The female terminalia (Figs 26-28) are unique by the very broad cerci which are not constricted against the remaining aculeus. Another unique character is the presence of a pair of small sclerotizations at the tip of sternite 8.

DESCRIPTION

This species differs from the description of the species group in the following points:

Head (Figs 1-2). Occiput entirely dark or with a paler stripe from posterior ocellar triangle to occipital foramen; gena mostly darkened, ventrally often paler; lateral extension of face yellow; clypeus and labrum yellow; colouration of postpedicel as in Fig. 2, but sometimes less extensively darkened; ocellar seta and anterior fronto-orbital seta about of same length, at most twice as long as setulae on frontal vitta.

Thorax. Postpronotum and notopleuron usually slightly paler than black dorsum of scutum; anterior half of pleura (proepisternum, anterior half of anepisternum) often reddish-black, posterior half of pleura usually entirely black; prosternum with 1 or several black setulae.

Wing (Fig. 4). Four dark areas present which are clearly separated from each other; basal dark area from base of wing through cell bc to tip of cell c and near tip with a ventral extension which reaches M_{1+2}; discal band from apical half of pterostigma over R-M; preapical band over DM-Cu crossvein; apical band at apex of R_{2+3}, with parallel borders, penetrating ventrally to middle of cell r_{4+5}, never touching tip of wing; basal half of pterostigma conspicuously yellowish.

Abdomen (Fig. 3). Grey stripe of tergum 3 in middle covers about anterior quarter to one third of maximal width of tergum.

Male terminalia (Figs 7-10). Cercus ovoid, very little sclerotized, in distal half with numerous long, soft setulae; longest setulae subapically at lateral margin of cercus; surstylus in profile rather narrow, both apical branches situated in one plane; distally clearly divided into two branches; lateral branch narrow, parallel-sided, curved for more than 90° in middle and slightly undulating near tip: tip not evenly rounded, but with an apical tooth ventrally; medial branch broad, flattened, distally produced in a finger like protuberance; both branches separated on ventral side through an incision; both black apical spines conspicuous; lateral spine only half as robuste than medial spine, inserted near base of lateral branch; spine on medial branch inserted on halfway of branch to tip, in basal half laterally with a large protuberance, therefore not evenly curved to tip; hypandrium and gonites as in other species; aedeagus long, coiled, with two rows of black, long setae.

Female terminalia (Figs 26-29). Oviscape black; aculeus parallel-sided; sternite 8 about half as long as total length of aculeus, at its tip with a pair of black spine-like sclerotizations internally; cerci almost continuous with remaining aculeus, no distinct constriction present; dorsally only with a small membranous transverse area; ventrally with an undulating ventral plate; distribution and length of setulae and setae as in other species; spermathecae dark brown sclerotized, of smooth surface, with a very short invagination; isolated spermatheca somewhat elongated, cylindrical; paired spermathecae more sphaerical.

Wing length. ♂: 3.45-4.60 mm. ♀: 3.83-4.68 mm. Holotype ♂: 4.34 mm.

DISCUSSION

Although the specimens studied and illustrated by Hennig (1939) were not examined in this study, it is clear that he depicted a specimen of *H. aartseni* on his Fig. 14, as can be seen when comparing it with Figs 9 and 24 of this paper. The male terminalia are superficially similar to *H. rivosecchii*. The differences indicated in the key and above, however, are very constant and there is no overlap in character expression in the shape of the surstylus and cercus and the position of the two black spines. The female differs more conspicuously from the other species of the group and it may be recognized without dissection if the tip of the aculeus is exposed.

Herina ghilianii Rondani, 1869 Figs 5, 11-13, 36-37

Herina ghilianii Rondani, 1869: 24. Type locality: Sicilia, Melita (see also Soós, 1982).

TYPE MATERIAL

Lectotype ♂ (designated by Soós, 1982: 136), "1608" (red printed label), "Lectotypus ♂ *Herina ghilianii* Rond. design. A. Soós 1978" (MZLS). 2♀♀ paralectotypes, both with red printed label "1608". One specimen with additional label "Paralectotypus ♂ *Herina ghilianii* Rond. desig. A. Soós, 1978", the other specimen with the label "Paralectotype ♀ *Herina ghilianii* Rond. desig. A. Soós, 1978" (MZLS).

Soós (1982) revised the types of *Herina* of Rondani and selected a lectotype for *H. ghilianii*. The specimen is in fair condition (pin rusty, specimen covered with debris, some setae on head broken off, both wings slightly broken). The genitalia are partly exposed and exhibit the characters shown on Figs 11-13, with both branches of the surstylus and the black spines clearly visible. It should be noted that both paralectotypes are females; one of it was mislabelled as male.

OTHER MATERIAL EXAMINED (11♂♂, 10♀♀)

Algeria: 2♂♂, La Croix, 1.IX.1913 (HNHM). **Italy**: 2♂♂, 2♀♀, Sicily, Pioppo, 28.VIII.1982, A. Freidberg (CBM, MHNG). **Malta**: 1♂, Ghajn Rihana, 16.IX.1977, leg. J. Schembri (CPG); 1♀, Fiddien, 25.VII.1978, leg. J. Schembri (CPG). **Tunisia**: 1♂, 3♀♀, Bel-Mehtia, 27. & 30.VIII.1913 (HNHM); 1♀, Oued el Meridj, 20.VIII.1913 (HNHM); 1♂, 1♀, La Calle, 28.IX.1913 (HNHM); 4♂♂, 2♀♀, Les Chênes, 10. & 12.IX.1913 (HNHM).

DIAGNOSIS

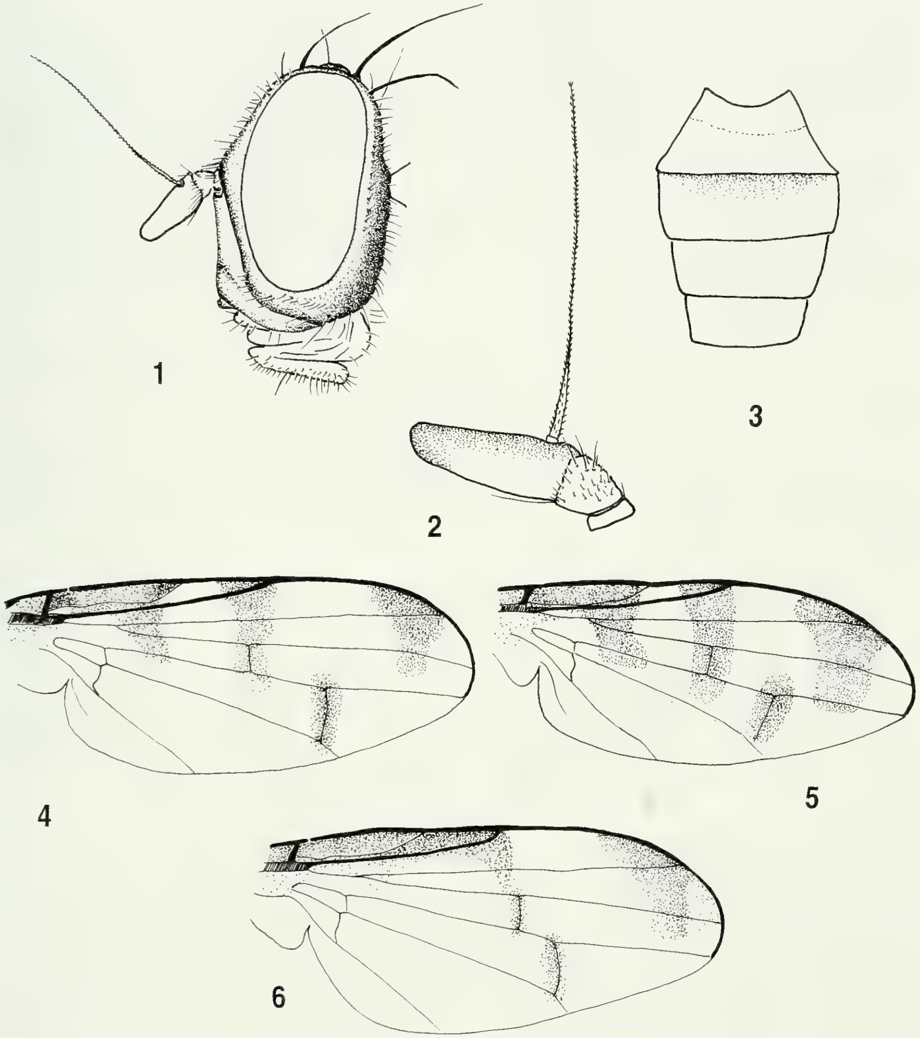
Usually this species may be recognized on external characters by the more extensive dark wing pattern with the longer apical crossband penetrating into m_{1+2} and the often slight trace of a longitudinal band along CuA_1 (Fig. 5). The same extensive wing pattern is otherwise only known from some British populations of *H. lugubris*. Male terminalia (Figs 11-13) somewhat similar to those of *H. lacustris*, but lateral branch of surstylus longer and more slender. Medial branch truncate, without finger-like process apically; both black spines close-set in the depression of the two branches; the lateral spine minute, only visible under a certain angle. Female terminalia (Figs 36-37) similar to those of *H. lacustris*, without internal sclerotization at tip of sternite 8. Wing length: ♂ & ♀: 3.85-4.05 mm. A very precise and detailed description of the type series was provided by Soós (1982) and does not need to be repeated here.

DISTRIBUTION

Italy (Sicily), Malta, Algeria, Tunisia (Soós, 1984; Rivosecchi, 1992)

Herina lacustris (Meigen, 1826) Figs 6, 14-17, 32-33

Ortalis lacustris Meigen, 1826: 280. Type locality: not given (according to Hennig, 1939: "wahrscheinlich die Umgebung von Aachen", according to Soós, 1984: "? Aachen").



Figs 1-6

Herina aartseni sp. n. (Figs 1-4), *Herina ghilianii* Rondani (Fig. 5) and *Herina lacustris* Villeneuve (Fig. 6): 1, head in lateral view; 2, antenna in maximal extension; 3, dorsal side of abdomen, grey microtrichose stripe dotted; 4-6, wing.

Herina nigrina var. *approximata* Villeneuve, 1921: 161. **syn. n.** Type locality: Tunisia, Aïn-Draham.

Herina approximata Villeneuve, 1921: Hennig, 1939: 61; Soós, 1984: 55.

TYPE MATERIAL OF *LACUSTRIS*

Lectotype ♂ (here designated): "Meigen" (upper side of round label, handwritten); "2411 40" (lower side of same round label, handwritten); "*lacustris*" (handwritten); "2214" (handwritten); "Lectotype" (red label, printed); "Lectotypus ♂ / *Ortalis* / *lacustris* Meigen, 1826 / desig. B. Merz 2001" (printed) (MNHNP).

The lectotype was originally directly pinned, but the head of the pin was cut off. The specimen is now pinned on a polyporous strip double-mounted on a large pin. The genitalia are dissected and stored in a glass vial that is attached to the specimen. The condition of the specimen is rather good (body covered faintly with debris, some setae broken, the right compound eye partly squashed, the left postpedicel missing and ptilinum partly exposed).

This species was described based on an unknown number of specimens. There is one specimen in the Meigen collection in Paris under this name (Becker, 1902), which could be studied. It fits well the original description (Meigen, 1826) and Meigen's illustration (Morge, 1975-1976, plate CCXX, Fig. 7) and was considered to be the "Typus" by Hennig (1939) without explanation. Because this statement is not a valid type fixation I am designating here this specimen as lectotype of *Ortalis lacustris* in order to fix unambiguously the identity of this species in this difficult species group.

TYPE MATERIAL OF *APPROXIMATA*

Syntypes, 2 specimens, Tunisia, Aïn-Draham, leg. von Bodemeyer [not examined].

Despite an extensive search for the two syntypes in the Villeneuve collection which is now housed in the Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels, they could not be found.

In the original description Villeneuve (1921) compared this species with *H. germinationis* (= *H. nigrina* Meigen), which has a very similar wing pattern, differing mainly in the position of the crossveins, which are more approximated. This character state is not known from any other *Herina* and the synonymy with *H. lacustris* seems to be without question.

OTHER MATERIAL EXAMINED (18♂♂, 10♀♀)

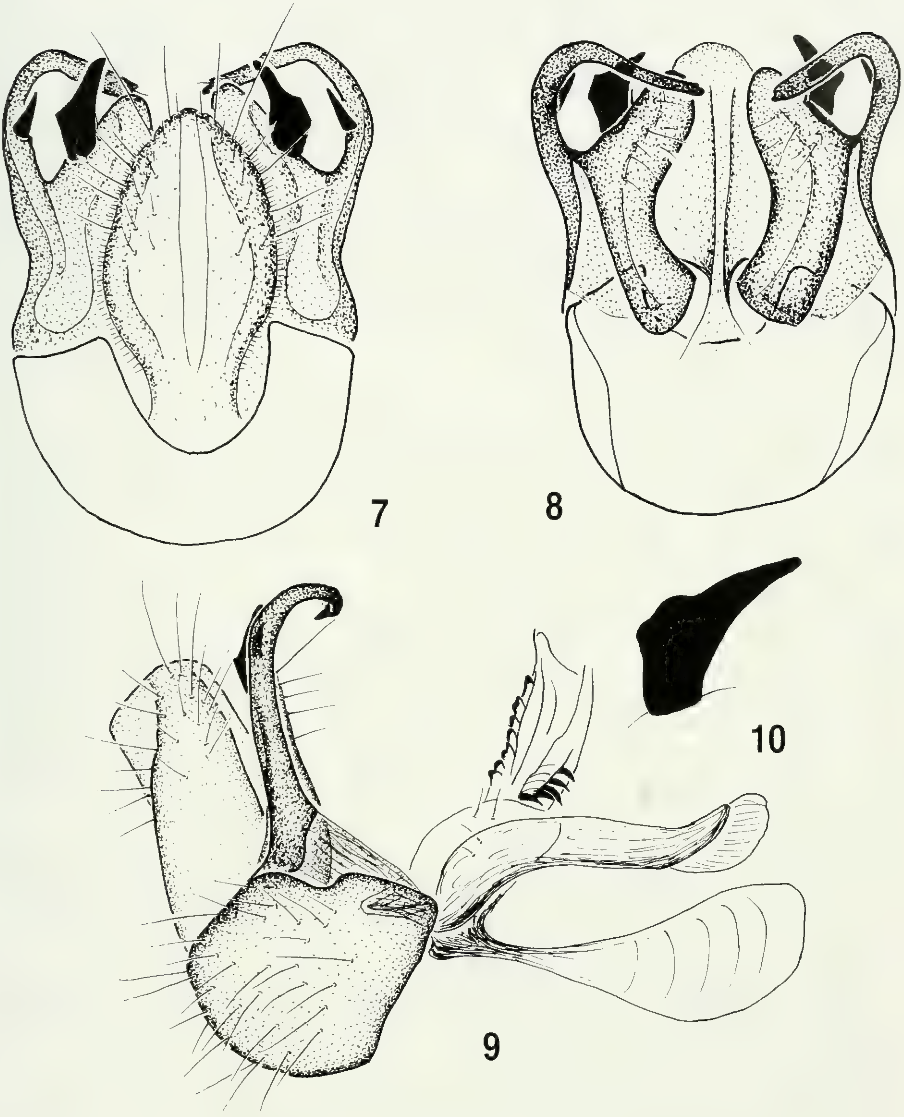
France: 3♂♂, 1♀, Ardèche: Lussas, 25.VII.-5.VIII.1968, leg. A. Terwoert (CBM, MHNG); 1♂, 1♀, Ardèche, Les Vans, 17.VIII.-1.IX.1974, leg. A. C. M. Terwoert (CBM, MHNG); 3♂♂, 2♀♀, Drôme prov., 850m, Col de Peyruergue (D64), 10.VII.1999, leg. B. Merz (CBM, MHNG); 6♂♂, 4♀♀, Drôme prov., 360m, Curnier (D64), 10.VII.1999, leg. B. Merz (CBM, MHNG); 1♂, Drôme prov., 820-950m, Chalancon/Col des Roustans (D135), 11.VII.1999, leg. B. Merz (CBM); 2♂♂, 1♀, Drôme prov., 420m, St. Ferréol-Trente-Pas, 11.VII.1999, leg. B. Merz (CBM); 1♂, Drôme prov., 500m, 5km SE Dieulefit (D538), 9.VII.1999, leg. B. Merz (CBM). **No locality**: 1♂, 1♀, coll. Wiedemann (NHMW).

DIAGNOSIS

As far as known, this is the only Western Palaearctic *Herina* in which the crossveins R-M and DM-Cu are closer together than the length of crossvein DM-Cu (Fig. 6). The basal and discal dark spot are fused in the basal half of the pterostigma. In some specimens the discal and preapical crossband are also fused, thus forming a continuous crossband from the pterostigma through both crossveins to the posterior margin of the wing. The apical crossband is extended to the tip of vein R_{4+5}, but the dark area posterior the tip of vein R_{2+3} is usually weaker and giving often the appearance of the tooth-like band as in the other species of the group. Tergite 3 of abdomen with a narrow parallel grey stripe basally which is not always well visible. Male terminalia (Figs 14-17): surstylus with both branches of almost the same length; the medial branch is not much larger than the lateral branch. The two black spines are close set in the depression of the two branches; the lateral spine is about half as long as the medial spine. The terminalia of the female (Figs 32-33) are rather similar to *H. ghilianii*, without internal sclerotization at tip of sternite 8. Wing length: ♂: 3.50-4.0 mm: ♀: 3.35-4.0 mm.

DISTRIBUTION

France, Portugal, Tunisia (Hennig, 1939; Soós, 1984)



Figs 7-10

Male terminalia of *Herina aartseni* sp. n.: 7, dorsal view (externally visible in resting position) of cercus and surstyli; 8, ventral view (from inside) of cercus and surstyli; 9, lateral view, only base of aedeagus shown; 10, black spine on medial branch in maximal extension.

Herina lugubris (Meigen, 1826) Figs 18-21, 34-35

Ortalis lugubris Meigen, 1826: 279. Type locality: not given (according to Soós, 1984: "? Germany").

Ortalis lugens Meigen, 1826: 279. Type locality: not given.

Ortalis afflicta Meigen, 1830: 378. Unjustified new name for *O. lugens* Meigen, 1826.
Herina longistylata Rivosecchi, 1992: 308. **syn. n.** Type locality: Italy, Marche, Grottammare.

TYPE MATERIAL OF *LUGUBRIS*

Holotype ♂: "Meigen" (upper side of round label, handwritten); "2422, 20" (lower side of same round label, handwritten); "*lugubris*" (handwritten); "2227" (small label, handwritten); "Lectotype" (red label, printed); "Holotypus ♂ / *Ortalis lugubris* Meigen, 1826 / desig. B. Merz 2001" (printed) (MNHNP).

Ortalis lugubris was described front one male (Meigen, 1826). The specimen in the MNHNP under this name (Becker, 1902) fits well the original description and Meigen's habitus illustration (Morge, 1975-1976, plate CCXX, Fig. 5) and must be considered as holotype. It is directly pinned and is in rather good condition (right wing slightly broken, pattern faint, body partly covered with debris, head slightly shrivelled). The genitalia are partly exposed and at a certain angle the two close-set spines in the saddle between the branches of the surstylus are clearly visible (cf. Figs 18-21).

TYPE MATERIAL OF *LUGENS*

Lectotype ♂ (here designated): "Meigen" (upper side of round label, handwritten); "*Ortalis afflicta*" (square label, handwritten); "Lectotype" (red label, printed); "Lectotypus ♂ / *Ortalis / lugens* Meigen 1826 / desig. B. Merz 2001" (handwritten); "*Herina / lugubris* Mg. / det. B. Merz'2001" (printed) (MNHNP). This specimen is in a good state of preservation (few setae on thorax, the right postpedicel and the right fore leg missing and the body slightly covered with some debris). The tip of the abdomen is removed, dissected, and stored in a glass vial in glycerol on the same pin as the specimen.

Paralectotype ♂: "Meigen" (upper side of round label, handwritten); "2419, 40" (lower side of same round label, handwritten"; "*Ortalis afflicta* (*lugens*)" (square label, handwritten); "Paralectotypus ♂ / *Ortalis lugens* Meigen, 1826 / desig. B. Merz 2001" (handwritten); "*Herina / lugubris* Mg / det. B. Merz'2001" (printed) (MNHNP). The specimen is in a good state of preservation. It was not dissected, but judging from the study of the base of the surstyli and cercus, it is the same species. A third specimen in very bad state of preservation (only thorax without legs or wings on the pin, one wing glued to the label), with a single handwritten label "Meigen" (on upper side) "2419, 40" (on lower side, MNHNP) is not designated as paralectotype. It belongs to *Herina germinationis* (Rossi, 1790) and was labelled accordingly.

The description of this species was based on an unknown number of specimens (Meigen, 1826). Three specimens stand below this name in the MNHNP, two of which fit the description, illustration of the wing (Meigen, 1826, plate 46, Fig. 27) and Meigen's habitus drawing (Morge, 1975-1976, plate CXLIV, Fig. 6). Because the type series of *O. lugens* is a mixture of two species, I am selecting here a lectotype in order to fix unambiguously the status of the species.

O. lugens seems to have been first synonymized with *O. lugubris* by Hennig (1939) who, however, did not state that he had studied the types of *O. lugens*. This synonymy is confirmed here by the examination of the genitalia of all types involved.

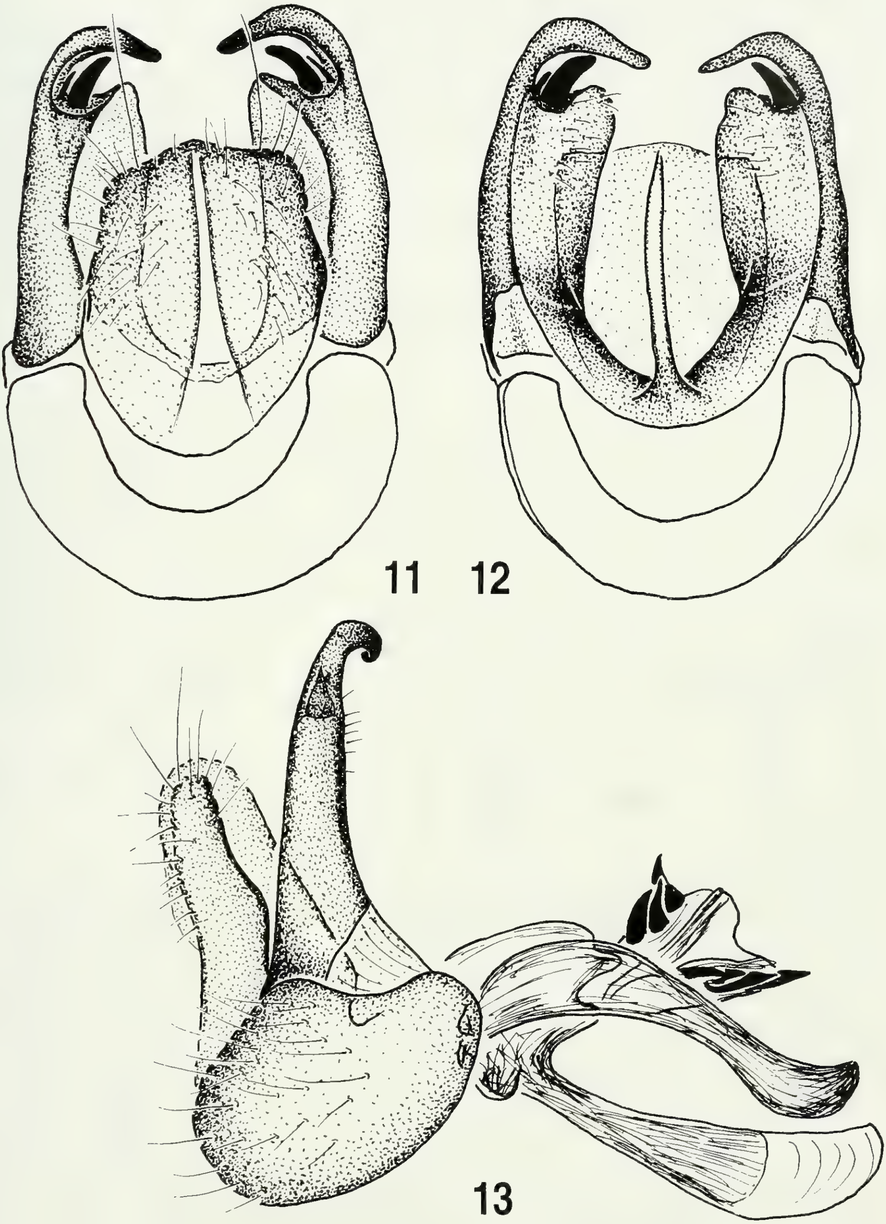
TYPE MATERIAL OF *LONGISTYLATA*

Holotype ♂: Italy, Marche, Grottammare, IX.1940, leg. Rivosecchi (CLR). [not examined]

Remark: According to a letter sent to the author by L. Rivosecchi dated 1 January 2002, the holotype was sent by post to him "già da molto tempo" (= a long time ago). Unfortunately the parcel never arrived in Geneva and the holotype is considered lost.

Paratype ♂: [**Italy**]: "Marche / 8.8.[19]40", "*H. longistylata* / paratipo / L. Rivos. leg e det.", "*Herina / lugubris* (Meig.) / det. B. Merz" (CLR). This specimen is in fair condition (some legs and setae missing) and is accompagnied by a permanent slide with one wing and the abdomen each under a separate coverslip. The slide is labelled "Marche 8'40", "*H. longistylata*, paratipo ♂, Grottammare 8.'40".

The terminalia of this paratype and the drawings provided by Rivosecchi (1992, Figs 3-5) leave no doubt to synonymy of *H. longistylata* with *O. lugubris* Meigen.



FIGS 11-13

Male terminalia of *Herina ghilianii* Rondani: 11, dorsal view (externally visible in resting position) of cercus and surstyli; 12, ventral view (from inside) of cercus and surstyli; 13, lateral view, only base of aedeagus shown.

OTHER MATERIAL EXAMINED (25♂♂, 45♀♀)

France: 1♂, "Gallia", coll. Thalhammer (HNHM); 5♂♂, 11♀♀, Ardèche, Lussas, 25.VII.-5.VIII.1968, leg. A. Terwoert (CBM, MHNG); 1♂, Ardèche, Les Vans, 17.VIII.-1.IX.1974, leg. A. C. M. Terwoert (CBM); 3♂♂, 2♀♀, Tardets, 10.VIII.1992, leg. Gijswijt (CBM); 3♀♀, Calvados, Colleville, 22-23.VIII.1926, leg. A. Naville; 3♀♀, same data, but 5.VIII.1928; 7♂♂, 15♀♀, same data, but VIII.1929 (MHNG); 1♂, Paris, coll. Winthem (NHMW). **Portugal**: 1♂, Santarem: Alviobeira (Tomar), 3.VIII.1995, leg. J. Pujade (CMCT). **Spain**: 1♂, 50km S. Granada, Sierra Almijara, Otiva, 1000-1500m, 5.X.1985, leg. A. Freidberg (TAU); 1♀, Loja, 6.X.1952 (MHNG); 1♀, Teruel, Alcaniz (Salada Grande), 31.VII.-8.VIII.1993, Malaise trap, leg. J. Anento (CMCT); 1♀, Daimiel, 15.IX.1952 (MHNG); 1♂, 3♀♀, Mallorca, Soller, 14/27.IX.1976, leg. B. J. Lempke (CMB, MHNG); 1♂, Mallorca, Ternellas, NW of Pollensa, 12/16.X.1974, leg. W. H Gravestein & S. J. v. Ooststroom (CBM, MHNG); 5♀♀, Mallorca, Puerto de Pollensa, 29.IX.-5.X.1974, leg. W. H Gravestein & S. J. v. Ooststroom (CBM). **No locality**: 3♂♂, coll. Winthem (NHMW).

DIAGNOSIS

In external characters this species cannot be separated from *H. aartseni* and *H. rivosecchii*. However, the terminalia are in both sexes very distinctive. Male terminalia (Figs 18-21): surstylus elongated, with a prominent, broad medial branch and a small, shorter, and appendice-like lateral branch which is turned medially at right angle in its distal half; black spines close-set in the saddle between the branches; the lateral spine much shorter than the medial spine; whole surstylus strongly concave in lateral view; cerci arrow-like, pointed at tip. Female aculeus (Figs 34-35) narrower than in other species of the group; sternite 8 simple, rugulose at tip. Supplementary notes on the morphology are given by Rivosecchi (1995) and Clements & Merz (1997, 1998). Wing length: ♂: 3.6-4.1 mm; ♀: 3.5-4-5 mm.

DISTRIBUTION

Italy (mainland), France, Spain (Mallorca, mainland), England (Rivosecchi, 1992; Clements & Merz, 1997, 1998).

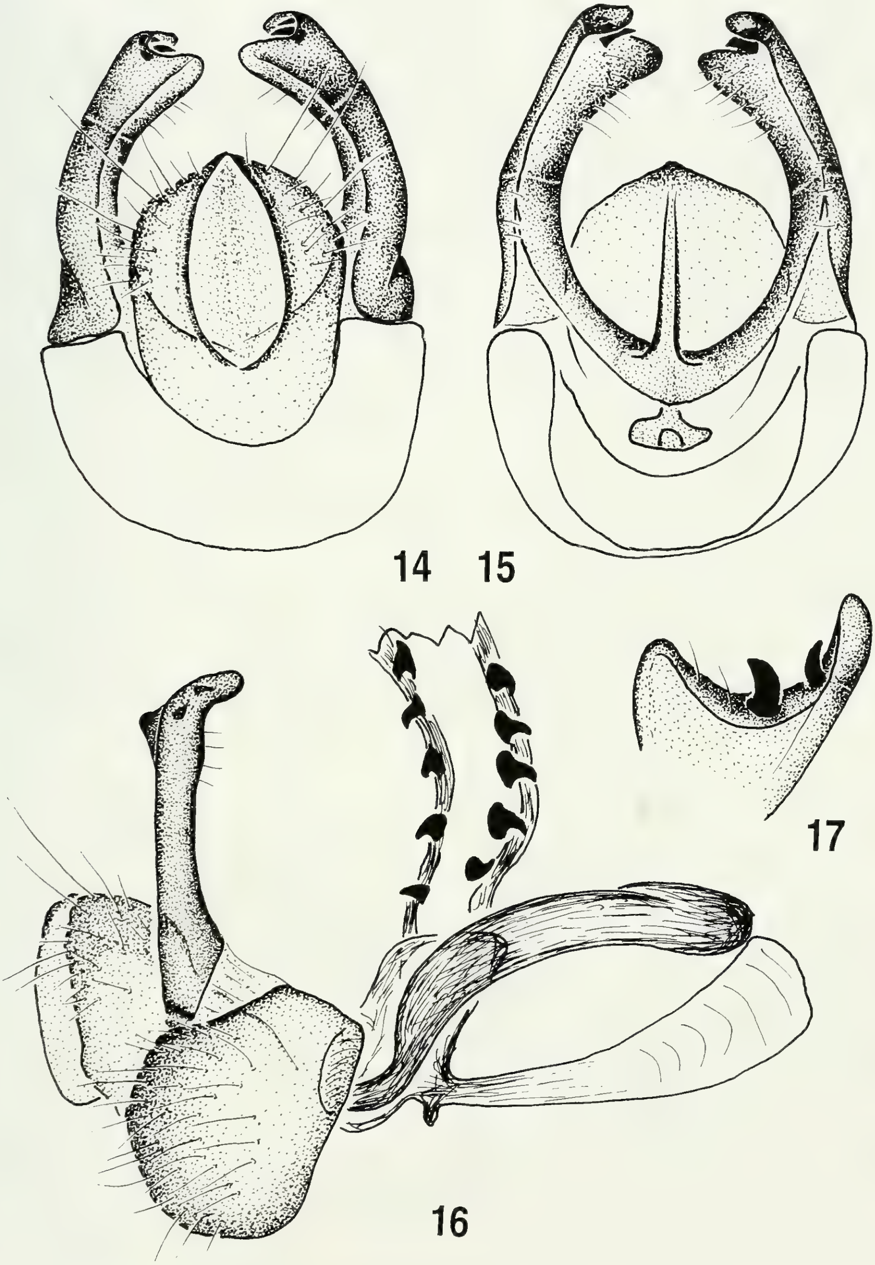
Herina rivosecchii sp. n. Figs 22-25, 30-31

Herina lugubris sensu Hennig, 1939 (description) nec Meigen, 1826: Rivosecchi, 1992: 312; Merz, 1996: 335; Clements & Merz, 1997: 65; Kameneva, 2000: 285.

MATERIAL (57♂♂, 37♀♀)

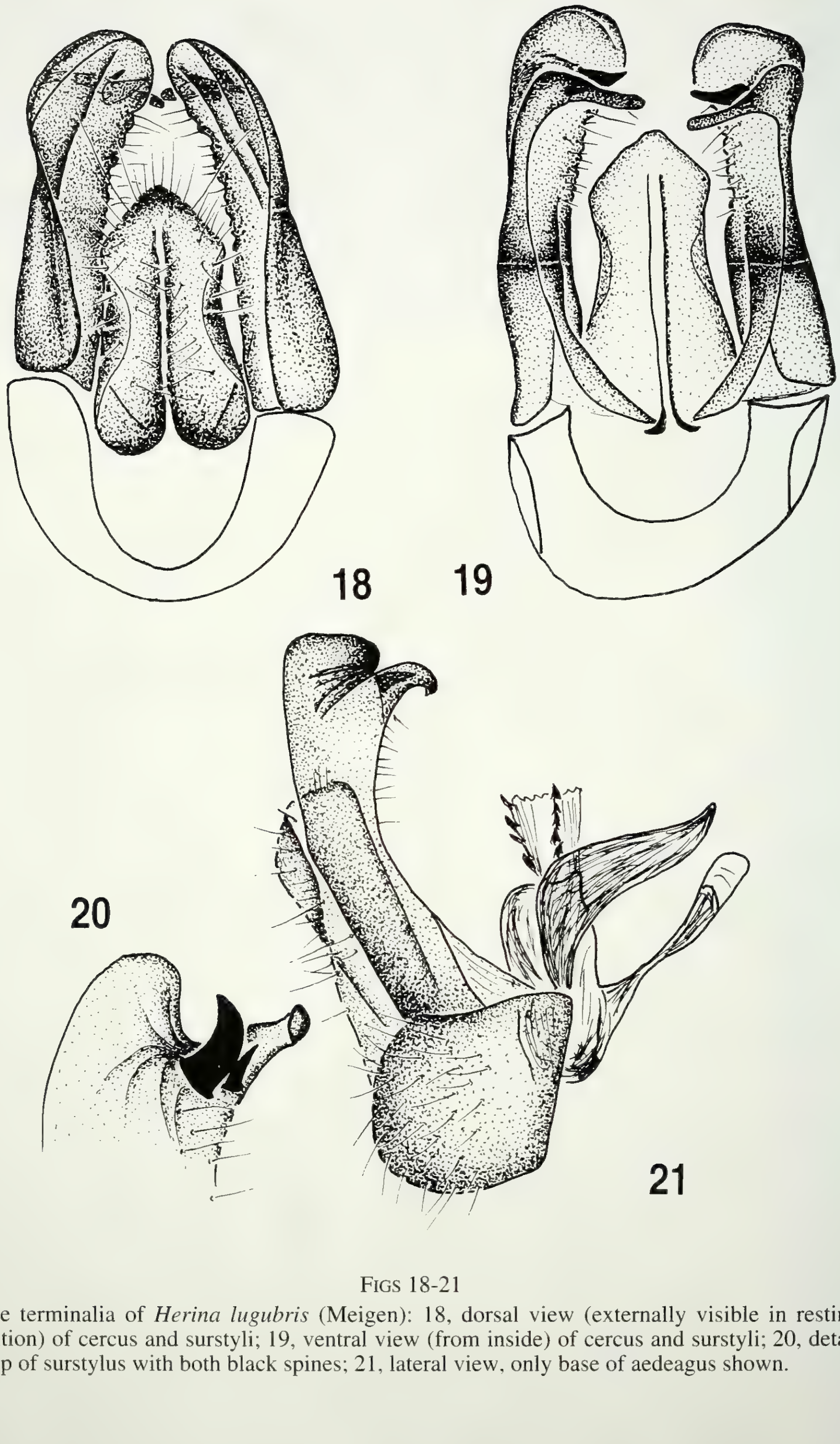
Holotype ♂: [**Switzerland**]: "Helv. GE, 350m / Cartigny/Moulin de / Vert 490700/ 115500 / 9.VII.2001/B. Merz", "Holotypus", "*Herina* / *rivosecchii* Merz ♂ / det. B. Merz 2001" (MHNG). The specimen is double-mounted on a minuten pin on a polyporous strip and is in excellent condition.

Paratypes: **Croatia**: 1♂, Crikvenica, 30.VIII.1965, leg. W. H. Gravestein (MHNG); 2♀♀, "Dalmatia, Arbe. Horv.", 12.VIII.1900 (HNHM); 3♂♂, 1♀, Novi, 12.VII.1900. leg. Kertesz (HNHM). **France**: 1♀, L'Arbe, leg. Horvath (HNHM); 1♂, Alpes-de-Ht. Provence, Montlaux, 16.VII.1988, leg. G. R. Langohr (MHNG); 1♂, Calvados, Colleville, 22-23.VIII.1926, leg. A. Naville (MHNG); 1♀, same data, but VIII.1929 (MHNG); 1♂, Yvoire, IX.1931, leg. A. Naville (MHNG); 1♀, same data, but VIII.1930 (MHNG); 1♂, Ht. Sav., 450m, Le Pas de l'Echelle, 27.VII.2000, leg. B. Merz (MHNG); 1♂, Ht. Sav., 700-900m, Monnetier, Pt. Salève, 10.VIII.2000, leg. Merz & Bächli (MHNG); 1♂, Cognac (MHNG); 4♂♂, Drôme prov., 820-950m, Chalancon, Col des Roustans (D135), 11.VII.1999, leg. B. Merz (CBM); 4♂♂, 4♀♀, Drôme prov., 850m, Col de Peyruergue (D64), 10.VII.1999, leg. B. Merz (CBM, MHNG); 1♂, Drôme prov., 500m, 5 km SE Dieulefit, (D538), 9.VII.1999, leg. B. Merz (CBM); 1♀, Drôme prov., 360m, Curnier (D64), 10.VII.1999, leg. B. Merz (CBM); 1♀,



FIGS 14-17

Male terminalia of *Herina lacustris* Villeneuve: 14, dorsal view (externally visible in resting position) of cercus and surstyli; 15, ventral view (from inside) of cercus and surstyli; 16, lateral view, only base of aedeagus shown; 17, detail of tip of surstylus with both black spines.



Figs 18-21

Male terminalia of *Herina lugubris* (Meigen): 18, dorsal view (externally visible in resting position) of cercus and surstyli; 19, ventral view (from inside) of cercus and surstyli; 20, detail of tip of surstylus with both black spines; 21, lateral view, only base of aedeagus shown.

Drôme pr., 740m, Col de Sausse (D 70), 10.VII.1999, a. L., leg. B. Merz (MHNG); 4♂♂, 3♀♀, Hte. Savoie, 520m, Bossey-Crévin, 27.VII.2000, leg. B. Merz (CBM, MHNG); 6♂♂, 2♀♀. Ardèche, Lussas, 25.VII.-5.VIII.1968, leg. A. Terwoert (MHNG, NHMW); 1♂, Richelieu, 28.VIII.1964, leg. J. Kugler (TAU); 1♂, Provence, Forcalquier, *Quercus* wood, 15.VIII.2000, leg. M. J. Ebejer (CME); 1♂, Hts. Alpes, 5km E Embrun, 1200m, 21.IX.1983, leg. C. Dufour, J.P. Haenni, P. Oosterbroek & H. Revier (MHNN); 1♂, Corse, Ponte Leccia, 200m, 22.VIII.1971, leg. A. C. & W. N. Ellis (MHNG). **Greece**: 1♂, 1♀, Lakonia, 7km SW Skala, 30.IX.1962 (MHNG); 5♂♂, 3♀♀, Kerkyra, Dassa, 5km SE Korakiana, 16-30.V.1971, leg. B. van Aartsen (MHNG); 1♂, Kerkyra, Or. Pantokrator, 900m, 16-30.V.1971, leg. B. van Aartsen (MHNG); 2♂♂, Rhodes, 1.-3.VII.1981, Malaise Trap, leg. A. Freidberg (TAU); 1♀, Crete, Meg. Chorafia, 8.VII.1978, leg. P. Neuenschwander (TAU); 1♂, Crete, Canea, VII. 1906, leg. Biro (HNHM). **Italy**: 4♂♂, Sicily, Pioppo, 28.VIII.1982, leg. A. Freidberg (TAU); 1♂, Sicily, 850m, Randazzo, Rummolo, Flascio River, 7.VI.1998, leg. B. Merz (CBM); 5♂♂, 5♀♀, Sicilia, M. Nebrodici, Biviere di Cesarò, 1250-1350m, 30.VII.-7.VIII.1961, leg. V. S. van der Goot (MHNG). **Spain**: 1♀, Huesca, Aisa, 1710m, 20.VIII.1985, leg. J. Isern (CMCT). **Switzerland**: 1♀, GE Genthod, leg. Frey-Gessner (MHNG); 3♀♀, GE, 350m, Cartigny, Moulin-de-Vert, 9.VIII.2000, leg. Merz & Bächli (MHNG); 1♂, 2♀♀, GE, 360m, Russin, Teppes-de-Biolay, 28.VIII.1999, leg. B. Merz (CBM); 1♂, 1♀, same data, but 9.VIII.2000 (MHNG); 1♀, GE, 400m, Russin, Les Baillets, 11.VIII.2000, leg. Merz & Bächli (MHNG); 1♂, 1♀, GE, Dardagny, La Tuilière, 5.IX.1993, leg. B. Merz (CBM); 1♂, VD, Aigle, leg. Maerky (MHNG); 1♂, ZH, Zürich-Hönggerberg, 2.-6.VIII.1997, leg. G. Bächli (CGB).

TAXONOMIC REMARKS

This well-known European species has been misidentified as *H. lugubris* by Hennig (1939), Rivosecchi (1992) and all subsequent authors (e. g., Merz, 1996; Clements & Merz, 1997, 1998; Martinek, 1997; Kameneva, 2000). Because of the synonymy of *H. lugens* and *H. longistylata* with *H. lugubris* no name was available for this species and the name *H. rivosecchii* is therefore proposed here.

ETYMOLOGY

The species is dedicated to L. Rivosecchi who was the first person to realize that *H. lugubris* is a complex of different species.

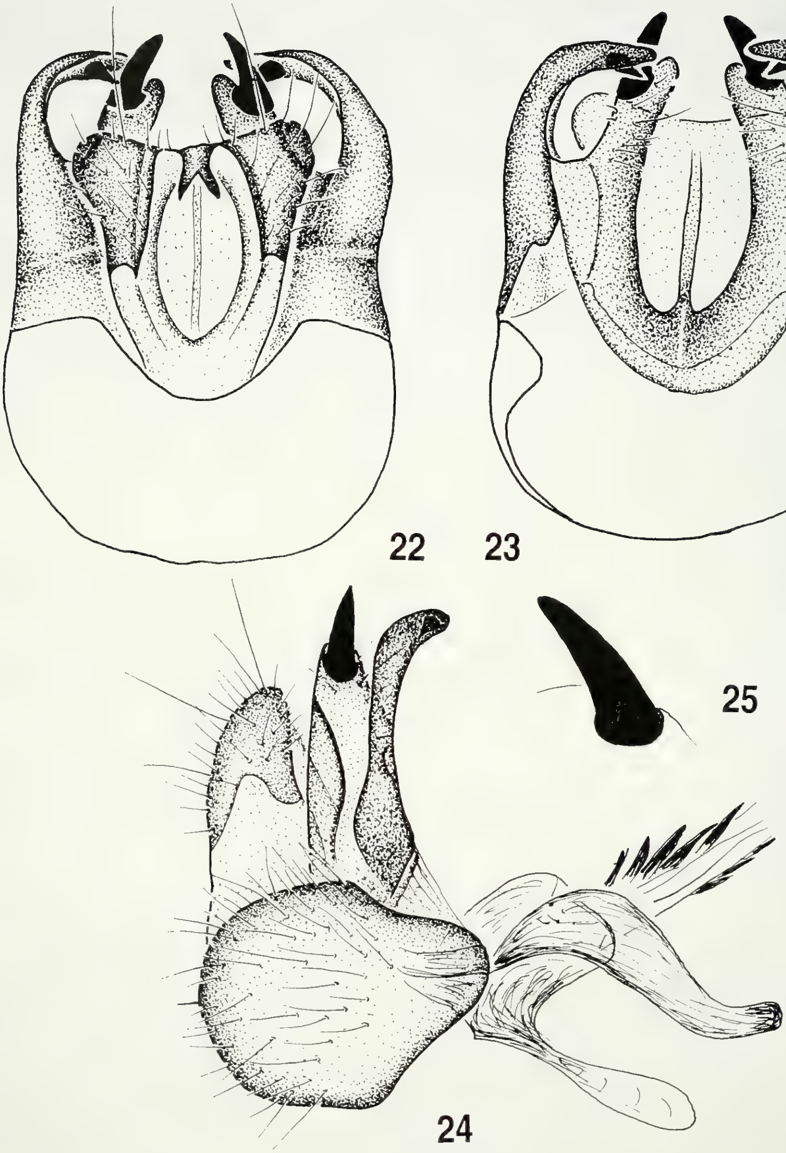
DIAGNOSIS

This species cannot be separated on external characters from *H. aartseni* and *H. lugubris*. The male terminalia (Figs 22-25) are characterized by the large, somewhat triangular cercus which is sclerotized apically. The lateral branch of the surstylus is curved at an angle of about 90° in apical half and evenly rounded at tip. The two black spines are widely separated from each other, the lateral spine is inserted at the tip of the lateral branch of the surstylus; the medial spine is much larger and of regular shape. The female terminalia (Figs 30-31) are characterized by the unpaired sclerotization at the tip of sternite 8 in the aculeus, and the cerci are clearly separated from the remainder of the aculeus by an unsclerotized area dorsally.

DESCRIPTION

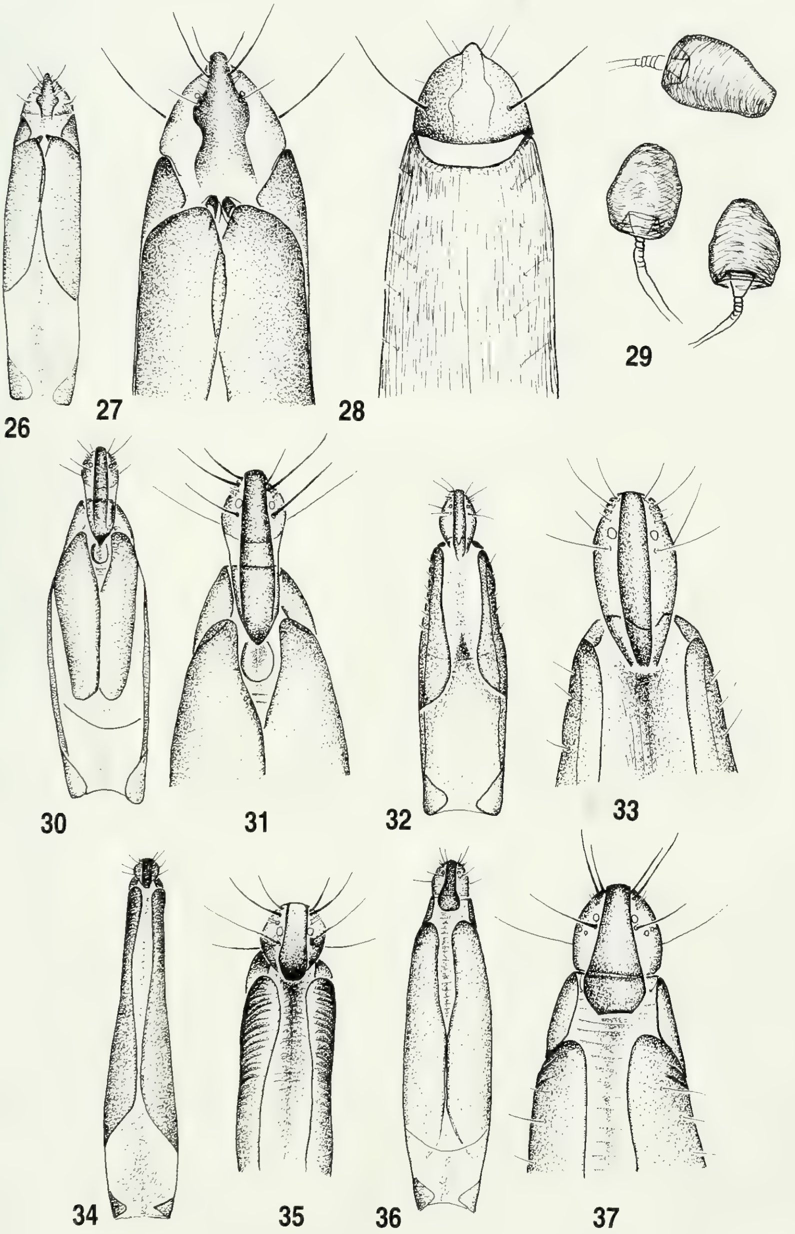
This species differs from the description of the species group in the following points:

Head. Interfrontal stripe, face and lower part of gena brownish-yellow, matt; ocellar triangle, occiput, posterior half of fronto-orbital plate and upper half of gena blackish; anterior half of fronto-orbital plate and parafacial densely covered with



FIGS 22-25

Male terminalia of *Herina rivosecchii* sp. n.: 22, dorsal view (externally visible in resting position) of cercus and surstyli; 23, ventral view (from inside) of cercus and surstyli; 24, lateral view, only base of aedeagus shown; 25, black spine on medial branch in maximal extension.



FIGS 26-37

Female terminalia and spermathecae of species of the *Herina lugubris* group: 26-29, *H. aartseni* sp. n.; 30-31, *H. rivosecchii* sp. n.; 32-33, *H. lacustris* (Meigen); 34-35, *H. lugubris* (Meigen); 36-37, *H. ghilianii* Rondani. 26-27 and 30-37, ventral view of entire aculeus (left) and of its tip (right); 28, tip of aculeus, dorsal view; 29, spermathecae.

silvery microtrichosity; clypeus and labrum yellowish, prementum darkened; antenna yellow, but postpedicel brownish-dark apically and dorsally to various extent. Frons covered with numerous black setulae; postpedicel dorso-apically slightly pointed, about 2.5-3 times as long as wide. Shape of head as in Fig. 1.

Thorax. Subshining black, covered with microtrichosity; postpronotum, proepisternum and scutellum often translucent reddish; prosternum with 1-3 black setulae laterally.

Wing. As in Fig. 4, with the basal half of the pterostigma yellow, with all 4 dark areas clearly separated from each other, and with the apical band tooth-like extending into cell r_{4+5}, leaving the apex of the wing hyaline.

Male terminalia (Figs 22-25). Superficially very similar to *H. aartseni*, but differing in details of the surstylus and the cercus: lateral branch of surstylus more robuste, curved distally only at about 90°, distally more or less straight, at apex evenly pointed; medial branch finger-like, narrower than in *H. aartseni*; the two black spines more separated from each other, the spine on the lateral branch almost at its tip, the medial spine evenly curved and inserted almost at tip of its branch; cercus of triangular shape, latero-apically with distinct sclerotization; the two branches of the surstylus in lateral position not in the same plane.

Female terminalia (Figs 30-31). Oviscape more or less shining black; sternite 8 about half as long as entire length of aculeus, at tip internally with an unpaired, ring-like sclerotization; cercus separated from remaining aculeus by distinct constriction, ventrally with a more or less parallel-sided, tongue-like sclerotized plate; chaetotaxy and spermathecae as in *H. aartseni*.

Wing length: ♂: 3.25-4.25 mm; ♀: 3.35-4.30 mm. Holotype ♂: 3.96 mm.

Remark: A more detailed description with additional illustrations of the head, antennae, wing and terminalia of both sexes is given by Merz (1996) under the name *H. lugubris*.

Distribution

Older records should be treated with caution because this species was in earlier times not separated from the other species of the group (e. g., Clements & Merz 1997, for Great Britain). In particular the limits of its distribution in south-eastern Europe are not clear. Based on published checklists, the species is known from the following countries: Austria, Belgium, Switzerland, Hungary, Croatia, Czech Republic, Germany, France (mainland and Corsica), Greece, Italy (mainland and Sicily), Slovakia.

PHYLOGENETIC CONSIDERATIONS

The phylogenetic relationships of *Herina* with the other genera of Ulidiidae are not well understood because the genus shows a high variability in external and genital characters, making it difficult to assess sister-group relationships. This question, however, is outside the scope of this paper and is therefore not further discussed.

The phylogenetic position of the *H. lugubris* species group and its relationships to other species groups of *Herina* are presented in Fig. 38. The numbers above the black squares refer to the apomorphic character states given below in brackets.

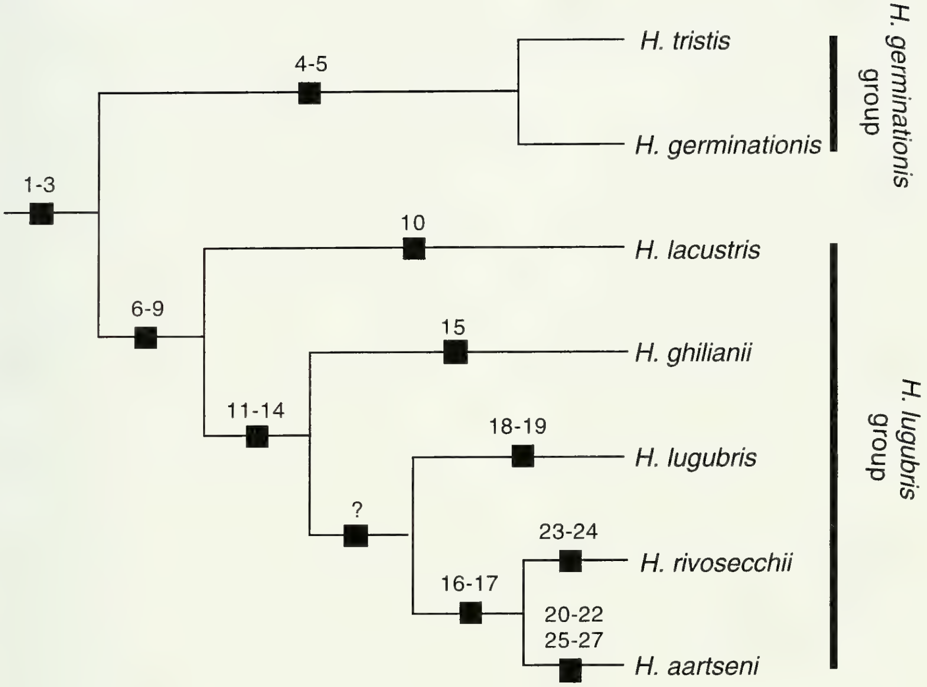


FIG. 38

Hypothetical phylogenetic relationships of *Herina germinationis* and *H. lugubris* species groups. The numbers above the black squares refer to the numbers in brackets in the section "Phylogenetic considerations" or in Table 1.

Within *Herina* the *H. lugubris* species group is probably related to the *H. germinationis* species group which includes *H. germinationis* (Rossi) and *H. tristis* (Loew). The species of both groups share the following synapomorphies: wing pattern with the complete discal crossband from the pterostigma to R-M (1) and the apically bifurcated surstylus (2) which carries distally two strong, black spines (3). Character-state (1) is not found elsewhere in Western Palaearctic *Herina* and is probably a good synapomorphy of the two species groups. The bifurcated surstylus (2) is also found in *H. paludum* (Fallén), but this species differs in head, wing and in structures of genitalia of males and females from both species groups. The most parsimonious solution indicates therefore that this character-state evolved at least twice in *Herina*. The presence of two strong, black spines (3) may occur in other species of *Herina*, but in that case they are of different shape and/or inserted at another place, and so are believed to be non homologous.

Species of the *H. germinationis* group differ from those of the *H. lugubris* group by the deep longitudinal rim which is formed by the surstylus (4) and the elongated, soft aculeus (5). Both characters are unique among Western Palaearctic *Herina* and support the monophyly of this group.

According to the present definition, the *H. lugubris* species group is characterized by the following autapomorphies:

(6) Abdomen shining black, but tergite 3 with a narrow grey stripe basally (Fig. 3).

Discussion: A study of all European species of *Herina* showed that the abdomen is either entirely shining black or covered with a pattern of microtrichosity. *H. tristis* is the only species with a grey stripe basally on tergite 3, but this species also has grey stripes on tergites 4 and 5, a character unknown in other *Herina*.

(7) Wing with the apical crossband parallel-sided, leaving the tip of the wing hyaline and giving therefore a banded appearance to the wing (Figs 4-5).

Discussion: This character is present in all species of the group, except *H. lacustris*. However, in this species the apical portion of the band is weaker than the remaining part, which is similar to the other species (Fig. 6). I have even seen two specimens where the apical portion joining the costa is almost entirely absent. No other species of European *Herina* has this type of apical crossband.

(8) Head narrow and elongate, about 1.5 times longer than wide (Fig. 1).

Discussion: The other species of the genus have the head usually wider (1.2-1.35 times longer than wide). However, this character depends on the condition of the specimens (head sometimes shrivelled) and should be treated with caution.

(9) Male surstylus with a broad medial branch apically (Fig. 22).

Discussion: The apically bifurcated surstyli are present in both the *H. germinationis* and *H. lugubris* species groups. Whereas both branches are of about the same size in the *H. germinationis* species group, they are clearly divided into a broad and usually shortened medial branch and a narrow, inclinate, lateral branch in the species of the *H. lugubris* species group. This type of bifurcation of the surstylus is not found elsewhere in *Herina*.

Within the *Herina lugubris* species group two main tendencies may be observed. First, the reduction of the wing pattern, in particular of the apical spot; and second, the enlargement and specialization of the medial branch of the surstylus. Following these tendencies, *H. lacustris* may be regarded as the most plesiomorphic species of the group: Both branches of the surstylus are almost of the same length, with the medial branch only a little bit more flattened (Figs 14-17). The wing has still a more extensive pattern than in the other species; in particular the apical band still follows the costa to the tip of vein R_{4+5}. An autapomorphy of *H. lacustris* is the approximation of both crossveins R-M and DM-Cu (10). This character is not found in any other *Herina*.

The other species undoubtedly form a monophyletic species group, which is supported by a number of synapomorphies:

(11) Grey stripe at base of tergite 3 broadened in the middle (Fig. 3).

Discussion: This type of pattern is not present in other species of *Herina*. If tergite 3 has a basal grey band, then it is always parallel and narrow (*H. tristis*, *H. lacustris*).

(12) Basal and discal dark spot on wing clearly separated by pale-yellow area in basal half of pterostigma (Figs 4-5).

Discussion: Few specimens of *H. germinationis* from southern Europe share this character, but this is regarded as independantly derived.

(13) Apical band of wing clearly separated from tip of wing, forming a straight band into cells r_{4+5} or m (Fig. 4).

Discussion: This character state is a strong support for the monophyly of the four included species. It is not found elsewhere in *Herina*. A reduction of the apical spot is already visible in *H. lacustris*, but in all specimens studied there are at least traces of brown pattern discernible at the wing tip.

(14) Lateral branch of surstylus medially curved, distinctly narrower than medial branch (Figs 19, 23).

Discussion: This is another good character state for postulating the monophyly of the four included species. The differentiation of the lateral branch of the surstylus into a long, medially curved process may be a functional advantage in holding the female during copulation. A similarly elongated lateral surstylus has also developed in the *Herina germinationis* species group, but this is probably based on an entirely different origin because it forms a long, straight rim together with the medial branch.

The remaining four species are externally very similar, except for *H. ghilianii* which has a larger apical spot that reaches down to cell m_{1+2} (15), an autapomorphy of this species. On the other hand, this species shows still some quite primitive structures of the terminalia with respect of the other three species. At the moment, no synapomorphy can be postulated to those for the monophyly of the group made of *H. aartseni*, *H. lugubris* and *H. rivosecchii*.

TABLE 1: Comparison of *Herina aartseni* sp. n. and *Herina rivosecchii* sp. n. The presumed apomorphic condition is highlighted in bold. Abbreviations: M = Male; F = Female. The number in brackets refer to Fig. 38.

Character	*Herina aartseni* sp. n.	*Herina rivosecchii* sp. n.
M: tip of lateral branch of surstylus	**with small tooth (20)**	evenly rounded
M: shape lateral branch	**thin, strongly curved at acute angle (21)**	thicker, curved at right angle
M: shape of black spine on medial branch	**with lateral projection (Fig. 10) (22)**	regularly curved (Fig. 25)
M: position of black spine on lateral branch	close to base of branch	**near tip of branch (23)**
M: sclerotization of cercus	more or less unsclerotized	**distally with sclerotization (24)**
M: shape of cercus	apically pointed	apically widened
F: shape of cercus	**basally broad, contiguous with remaining aculeus (25)**	distinctly separated from remaining aculeus
F: ventral plate of cercus	**undulating (26)**	straight
F: sclerotization at tip of sternite 8	**paired, small (27)**	unpaired, large

The analysis of the relationships of the three species mentioned above indicates a sister-group relationship of *H. aartseni* and *H. rivosecchii.* In these two species both dark spines at the tip of the surstylus are clearly separated from each other (Figs 7, 22) (16) and both species exhibit an internal sclerotization at the tip of sternite 8 in the female (Figs 27, 31) (17). Neither character state is found in other *Herina*. *H. lugubris* has a remarkably enlarged medial branch of the surstylus that is much longer than the lateral branch (18) and the cercus is arrow-like (19) (Figs 18-19), both character states are unique to this species.

The comparison of characters for *H. aartseni* and *H. rivosecchii* is shown in Table 1. The most important characters that help to separate the two species phylogenetically are Nr. 22, 23 and 25. It is difficult to decide on the polarity of the character “shape of cercus in male”. In *H. aartseni* the cercus is apically pointed, but in *H. rivosecchii* it is widened apically. Neither character state occurs in other species of the group.

ACKNOWLEDGEMENTS

It is my pleasure to thank here B. van Aartsen (t'Harde) very much for sorting and pinning all specimens of one new species and for his gift of numerous specimens which formed the base of the present study. Further, I want to express my thanks to G. Bächli (Zürich), M. Carles-Tolrà (Barcelona), R. Contreras-Lichtenberg (Wien), M. Ebejer (Balzan), A. Freidberg (Tel Aviv), P. Gatt (Rabat), L. Greve-Jensen (Bergen), and L. Papp (Budapest) for the loan of numerous specimens as well as to Mrs J. Charbonnel (Paris) for the loan of the types of Meigen and to Mrs S. Whitman (Firenze) for the loan of Rondani's types. P. Grootaert (Brussels) and H. Dirickx (Genève) are acknowledged for their efforts in searching the types of Villeneuve. I express a very special thank to L. Rivosecchi (Roma) for sending me the types of *H. longistylata* and his scientific help during the preparation of the paper. My thanks are extended also to E. Kameneva and V. Korneyev (Kiev) for the copy of the unpublished thesis of Elena, and to them and to D. Clements (Cardiff), to B. Landry and to Ch. Lienhard (both Genève) for carefully reviewing this manuscript.

REFERENCES

BECKER, TH. 1902. Die Meigen'schen Typen der sogen. Muscidae acalypterae (Muscaria holometopa) in Paris und Wien. *Zeitschrift für systematische Hymenopterologie und Dipterologie* 2: 209-256.

CLEMENTS, D. K. & MERZ, B. 1997. The identity of '*Herina lugubris*' in Britain and its confusion with *H. longistylata* (Diptera, Ulidiidae). *Dipterists Digest* 4 (2): 65-67.

CLEMENTS, D. K. & MERZ, B. 1998. Key to the genus *Herina* (Diptera, Ulidiidae) in Britain. *Dipterists Digest* 5 (2): 55-67.

HENNIG, W. 1939. 46./47. Otitidae. *In*: LINDNER, E. (ed.). *Die Fliegen der Palaearktischen Region* 5: 1-78 & 13 plates.

KAMENEVA, E. P. 2000. Picture-winged flies (Diptera, Ulidiidae) of the Palaearctic region (Fauna, Morphology, Systematics). *Unpublished thesis submitted to the National Academy of Ukraine, Schmalhausen Institute of Zoology*. 332 pp. (in Ukrainian).

MARTINEK, V. 1997. Lauxaniidae. *In*: CHVALA, M. (ed.). Check List of Diptera (Insecta) of the Czech and Slovak Republics, 130 pp. *Charles University Press, Prague.*

MEIGEN, J. W. 1826. Systematische Beschreibung der bekannten Europäischen zweiflügeligen Insekten. Vol. 5. 412 pp. *Hamm.*

MERZ, B. 1996. Systematik und Faunistik der Gattung *Herina* (Diptera, Otitidae) der Schweiz. *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 69 (3-4): 329-344.

MORGE, G. 1975-1976. Dipteren-Farbtafeln nach den bisher nicht veröffentlichten Original-Handzeichnungen Meigens: "Johann Wilhelm Meigen: Abbildung der europaeischen zweiflügeligen Insecten, nach der Natur". *Beiträge zur Entomologie* 25 (2) (1975): 383-500 & plates 1-80; Vol. 26 (1) (1976): plates 81-160; Vol. 26 (2) (1976): plates 161-305.

PAPP, L. & DARVAS, B. (eds) 2000). Contributions to a Manual of Palaearctic Diptera. Volume 1. *Science Herald, Budapest.* 978 pp.

RIVOSECCHI, L. 1992. Una nuova specie del genere *Herina* proveniente dall'Italia Centrale (Diptera, Acalyptera, Otitidae). *Fragmenta Entomologica* 23 (2): 307-313.

RIVOSECCHI, L. 1995. Contributo alla conoscenza degli Otitidi Italiani (Diptera, Acalyptrata, Otitidae). *Bollettino dell'Associazione Romana di Entomologia* 49 (3-4): 75-117.

RONDANI, C. 1869. Ortalidinae Italicae collectae, distinctae et in ordinem dispositae. Diptera Stirps XX. Ortalidinae Rndn. *Prodomus Dipterologicae Italicae*, Pars VII, Fasc. 3: 5-37.

SOOS, A. 1982. Wiederbeschreibung zweier Rondanischen Otitiden-Arten (Diptera). *Acta Zoologica Academiae Scientiarum Hungaricae* 28 (1-2): 133-137.

SOOS, A. 1984. Family Otitidae (Ortalidae). *In*: SOOS, A. & PAPP, L. (eds). Catalogue of Palaearctic Diptera. Vol. 9, 460 pp. *Akadémiai Kiado, Budapest.*

STUCKENBERG, B. R. 1999. Antennal evolution in the Brachycera (Diptera), with a reassessment of terminology relating to the flagellum. *Studia Dipterologica* 6 (1): 33-48.

VILLENEUVE, J. 1921. Description de Diptères nouveaux. *Annales de la Société entomologique Belge* 61: 157-161.

REVUE SUISSE DE ZOOLOGIE 109 (2): 433-467; juin 2002

Revisione del genere *Acallorneuma* Mainardi, 1906 (Coleoptera, Curculionidae, Cryptorhynchinae) *

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Revision of the genus *Acallorneuma* Mainardi, 1906 (Coleoptera, Curculionidae, Cryptorhynchinae). - The taxonomic revision of the genus *Acallorneuma* Mainardi, 1906 is here presented. To the four species previously known: *Acallorneuma reitteri* Mainardi, 1906 (Central Italy, Arpino), *A. doderoi* A. & F. Solari, 1908 (Sicily, Ficuzza), *A. mainardii* A. & F. Solari (Sardinia, Seui), *A. peyerimhoffi* F. Solari, 1938 (Algeria, Guerrouch), six species new to science are added: *A. ingoi* (Central Italy, San Donato Val Comino), *A. sabellai* (Sicily, Erice), *A. montisalbi* (Sardinia, Monte Albo), *A. poggii* (Sardinia, Dorgali), *A. sardiniensis* (Sardinia, Lula), *A. gasparoi* (Sardinia, Dorgali). For each taxon an accurate diagnosis and all disposable data about geographical distribution, biology and ecology are supplied. A key to species and a cladistic analysis are also given.

Key-words: Curculionidae – Cryptorhynchinae – *Acallorneuma* – new species – taxonomy – ecology.

INTRODUZIONE

Il genere *Acallorneuma* Mainardi 1906 venne descritto per inquadrare un Criptorinchino (*A. reitteri* Mainardi, 1906) caratterizzato da un solco prosternale profondamente incavato tra le procoxe e da un vistoso dente femorale. In base poi alla morfologia generale [non troppo dissimile dai *Kyklioacalles* Stüben, 1998 (=*Acalles* Schönherr, 1826 partim) del gruppo *punctaticollis* (Lucas, 1849)], il descrittore ritenne il nuovo taxon intermedio tra *Acalles* s.l. e *Torneuma* Wollaston, 1860. Nessun cenno invece sulla maggiore larghezza delle elitre rispetto al pronoto e sulla vestitura dei tegumenti (squamulosa in *Acalles* s. l., del tutto assente in *Torneuma*) che, in *Acallorneuma*, è costituita da minuscole setole semirilevate.

I due *Acallorneuma* successivamente diagnosticati (*A. doderoi* A. & F. Solari, 1908: Sicilia; *A. mainardii* A. & F. Solari, 1908: Sardegna), pur conservando l'habitus tipico del genere, risultano privi di vistoso dente femorale, mentre una quarta specie (*A. peyerimhoffi* F. Solari, 1938: Algeria), contrariamente all'affermazione di Solari (che la avvicina ad *A. reitteri*), presenta due minuscoli rilievi

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dentiformi sui femori. Poichè su queste discrepanze nessun autore si è mai soffermato e poichè, come più sopra accennato, gli *Acallorneuma* presentano una facies non troppo dissimile a quella dei *Kyklioacalles*, abbiamo ritenuto opportuno approfondire criticamente il valore sistematico sia del genere sia delle varie specie ad esso attribuite soprattutto con lo studio comparato delle armature genitali.

L'attuale collocazione sistematica degli *Acallorneuma*, secondo Alonso-Zarazaga & Lyal (1999), è trà i Cryptorhynchinae Schönherr, 1825 tribù Cryptorhynchini Schönherr, 1825 sottotribù Tylodina Lacordaire, 1866.

Questa ricerca, mentre da una parte ci ha confermato la piena validità del genere *Acallorneuma*, dall'altra ci ha convinto che esso si avvicina massimamente agli *Acalles* s. l. benchè, sia per la peculiare conformazione dello spiculum ventrale sia per la distribuzione ristretta al bacino del Mediterraneo occidentale, esso occupi una posizione alquanto isolata nell'ambito della sottofamiglia e, forse anche, dei Tylodina.

MATERIALI E METODI

Il presente studio si basa sull'esame di 436 esemplari conservati nelle seguenti collezioni pubbliche e private:

(MGCD) Museo Civico di Storia Naturale "G. Doria", Genova, Italia (collezione A. Dodero e collezione generale).

(MSNM) Museo Civico di Storia Naturale, Milano, Italia (collezione F. Solari e collezione generale).

(MSNF) Museo di Storia Naturale "La Specola", Firenze, Italia.

(MRSN) Museo Regionale di Scienze Naturali di Torino, Italia (collezione generale).

(MSNV) Museo Civico di Storia Naturale di Verona, Italia (collezione P. Zangheri e collezione generale).

(MCZR) Museo Civico di Zoologia, Roma, Italia (collezione Ceruti, P. Luigioni e collezione generale).

(MHNG) Museo di Storia Naturale di Ginevra, Svizzera.

(INE) Istituto Nazionale di Entomologia, Roma, Italia.

P. Abbazzi (Firenze) (Ab), C. Pesarini (Milano) (Ps), M. Meregalli (Torino) (Mer), C. Meloni (Cagliari) (Mel), I. Wolf (Germania) (IW).

Quando non viene riportata alcuna sigla i materiali si intendono collocati nella collezione G. Osella al Dipartimento di Scienze Ambientali, L'Aquila.

Gli olotipi delle nuove specie sono collocati nei seguenti Musei: MSNM (*A. reitteri*, *A. doderoi*, *A. mainardii*, *A. peyerimhoffi*), MGCD (*A. montisalbi*, *A. poggii*, *A. sardiniensis*), MHNG (*A. ingoi*), MSNV (*A. gasparoi*, *A. sabellai*).

Tutti i dati ecologici relativi ad *A. reitteri* ed *A. ingoi* sono il risultato delle nostre indagini di campo svolte nell'Appennino centrale.

Le misure morfometriche sono state effettuate con un oculare micrometrico allo stereomicroscopio Wild TYP 181300. La lunghezza del corpo è stata misurata dal margine anteriore del rostro lungo la linea mediana all'apice delle elitre. Le antenne sono state misurate dal punto di inserzione dello scapo fino alla clava (Lusc =

lunghezza dello scapo; Lufu = lunghezza del funicolo; Lucl = lunghezza della clava). Il rostro (Luro) è stato misurato dall'apice (escluse le mandibole) alla base, dove il margine dorsale delle scrobe raggiunge gli occhi. La lunghezza del protorace (Lupr) è stata misurata lungo la linea mediana, dall'apice alla base; la larghezza (Lapr) è stata misurata trasversalmente nel punto di maggiore larghezza. La lunghezza delle elitre (Luel) è stata misurata lungo la linea mediana, dalla base all'apice; la larghezza (Lael) è stata misurata trasversalmente nel punto di maggiore larghezza.

Per quanto riguarda le armature genitali si è provveduto al distacco degli ultimi tre urosterniti; questi poi sono stati immersi in KOH al 10% per 24 ore e successivamente in acido acetico. Edeago, spiculum gastrale e spermateca sono stati disegnati alla camera lucida (stereomicroscopio Wild TYP 181300). Per lo spiculum ventrale si è utilizzato invece il microscopio ottico a contrasto di fase (Leitz Ortholux 2) per evidenziare le parti meno sclerificate dello stesso. La terminologia per la descrizione delle armature genitali è quella utilizzata da O'Brien & Askevold (1992).

Acallorneuma Mainardi, 1906

Specie tipica: *A. reitteri* Mainardi, 1906 (per monotipia)

Mainardi, 1906: 151. Reitter, 1912: 63. Reitter, 1916: 135. Porta, 1932: 192. Hustache, 1936: 95-96. Abbazzi & Osella, 1992: 339. Abbazzi *et al.*, 1994: 40.

Ridescrizione. Corpo cilindrico-allungato, convesso, tegumenti bruno neri (rossicci negli esemplari immaturi), desquamulati, debolmente brillanti, variolosamente punteggiati, con setole semierette. Rostro subcilindrico, ricurvo, leggermente strozzato alla base, appiattito dorsalmente e carenato-punteggiato, a lati subparalleli; mandibole caduche bidentate. Antenne rossicce inserite nel 1/3 apicale; scapo cilindrico appena ingrossato distalmente; funicolo di 7 articoli, debolmente setolosi; clava di 4 articoli compatti. Scrobe subparallele, debolmente ingrossate che all'indietro raggiungono gli occhi. Occhi appiattiti, nascosti dal protorace quando il rostro è a riposo, con 12-24 ommatidi. Pronoto più lungo che largo (lungo quanto largo solo in A. *sabellai* e A. *peyerimhoffi*), più stretto delle elitre, maggiore ampiezza all'incirca a metà, con punti più o meno irregolarmente disposti sul disco. Prosterno profondamente incavato a margini rilevati e, distalmente, chiuso a semicerchio all'altezza delle coxe mediane. Scutello piccolo, sferico o subtriangolare. Elitre cilindrico-allungate, circa una volta e mezza più lunghe che larghe, convesse, subrettilinee alla base, con strie fortemente punteggiate, interstrie evidenti in numero di 9, omeri arrotondati. Strie ed interstrie con minuscole setole, più appariscenti sulle interstrie. Meso e metasterno con setole evidenti. Zampe robuste con un dente mediano evidente (*A. reitteri* e *A. montisalbi*) o con lieve carena longitudinale, talvolta crenellata (restanti specie). Femori punteggiati con setole. Tarsi a 1° articolo oblungo-conico, 2° trasverso, 3° bilobo; onichio con unghie libere, molto gracili. Coxe anteriori rilevate, separate dal rilievo semicircolare che chiude il canale rostrale. Coxe mediane meno rilevate, separate dal rilievo semicircolare che chiude il canale rostrale da uno spazio pari a quello che si osserva per le coxe anteriori; coxe metatoraciche appiattite, separate da uno spazio circa doppio rispetto alle precedenti. Meso e metasterno con setole evidenti. Urosterniti 1° e 2° ampi, brillanti e privi di setole, saldati alla sutura, con profonda punteggiatura rotonda disposta quasi regolarmente in più file di 6-8 punti ciascuna. Urosterniti 3° e 4° stretti, impunteggiati; 5° urosternite subtriangolare più largo del 3° e 4° sommati insieme, fortemente punteggiato, setoloso.

Armatura genitale maschile. Lobo mediano con superficie dorsale (esclusa l'area dell'orifizio) leggermente sclerificata; superficie ventrale membranosa a lati più o meno paralleli; apice non allungato, largamente ed uniformemente arrotondato, in visione laterale moderatamente curvato, affusolato, strettamente arrotondato; apice estremo uniformemente arrotondato (*A. reitteri*); allungato, più o meno triangolare, subacuto, strettamente arrotondato (*A. ingoi*, *A. doderoi*, *A. mainardii*, *A. sardiniensis, A. gasparoi*); piuttosto allungato, largamente subacuto (*A. montisalbi*). Orifizio più o meno ovale, corto (allungato solo in *A. montisalbi*), con margine prossimale distinto. Apodemi sottili, di larghezza più o meno uniforme, lunghi circa il doppio del lobo mediano. Un carattere molto importante per l'identificazione delle specie di *Acallorneuma* è senza alcun dubbio la struttura del sacco interno, presente nella parte basale del lobo mediano. In questo lavoro non è stato possibile descrivere in maniera dettagliata questa struttura per due motivi; a) di *A. sabellai* n. sp., *A. poggii* n. sp. ed *A. peyerimhoffi* Solari sono conosciute solo le femmine; b) per le altre specie (ad eccezione di *A. reitteri* Mainardi ed *A. wolfi* n. sp.) questa struttura, trattandosi di materiale storico già dissezionato in passato, è andata persa durante l'estrazione delle armature genitali. Armatura interna: Fig. 5d.

Armatura genitale femminile. VIII sternite con setole apicali allungate, alcune molto corte, sottili, semplici o a più punte; lamine apicalmente convergenti, con margini interni largamente arcuati, con margini esterni largamente emarginati. Apodemi largamente divergenti verso la base, saldati (*A. ingoi, A. doderoi, A. sabellai, A. mainardii, A. poggii, A. sardiniensis, A. gasparoi*) o contigui alla base (*A. peyerimhoffi* e *A. reitteri*). Spermateca con ramus corto (indistinto in *A. sabellai* e *A. gasparoi*) o debolmente esteso dietro l'inserzione del dotto spermatico, distinto dal corpo da una leggera emarginazione (*A. ingoi, A. doderoi, A. mainardii*); profilo uniformemente continuo con il corpo (Figg. 6a-f; 7a-f).

Particolarmente significativa la struttura dello spiculum ventrale, bipartito, talvolta sin dalla base, a rami divergenti anzichè a "paletta" come negli altri Criptorinchini euromediterranei. Questa peculiare conformazione ricorda alla lontana *Rhynchodes ursus* White, 1846 Criptorinchino delle isole Kermadec (Nuova Zelanda) (Lyal, 1993).

Sintetizziamo nelle righe seguenti le differenze più significative che separano *Acallorneuma* dagli altri Criptorinchini euromediterranei.

Acalles s. str., *Ruteria* Roudier, 1954 e *Dichromacalles* s. l. Stüben, 1999, differiscono da *Acallorneuma* per il corpo compatto, fortemente convesso, densamente squamulato, con elitre larghe solo quanto il pronoto, con punteggiatura e strie elitrali mal visibili (perchè mascherate dalle squame), per i femori inermi, per gli occhi più larghi non appiattiti e per lo spiculum ventrale a "paletta".

Kyklioacalles Stüben, 1999 (che condivide con *Acallorneuma* il corpo allungato meno convesso dorsalmente e le elitre fortemente striato-punteggiate) si diffe-

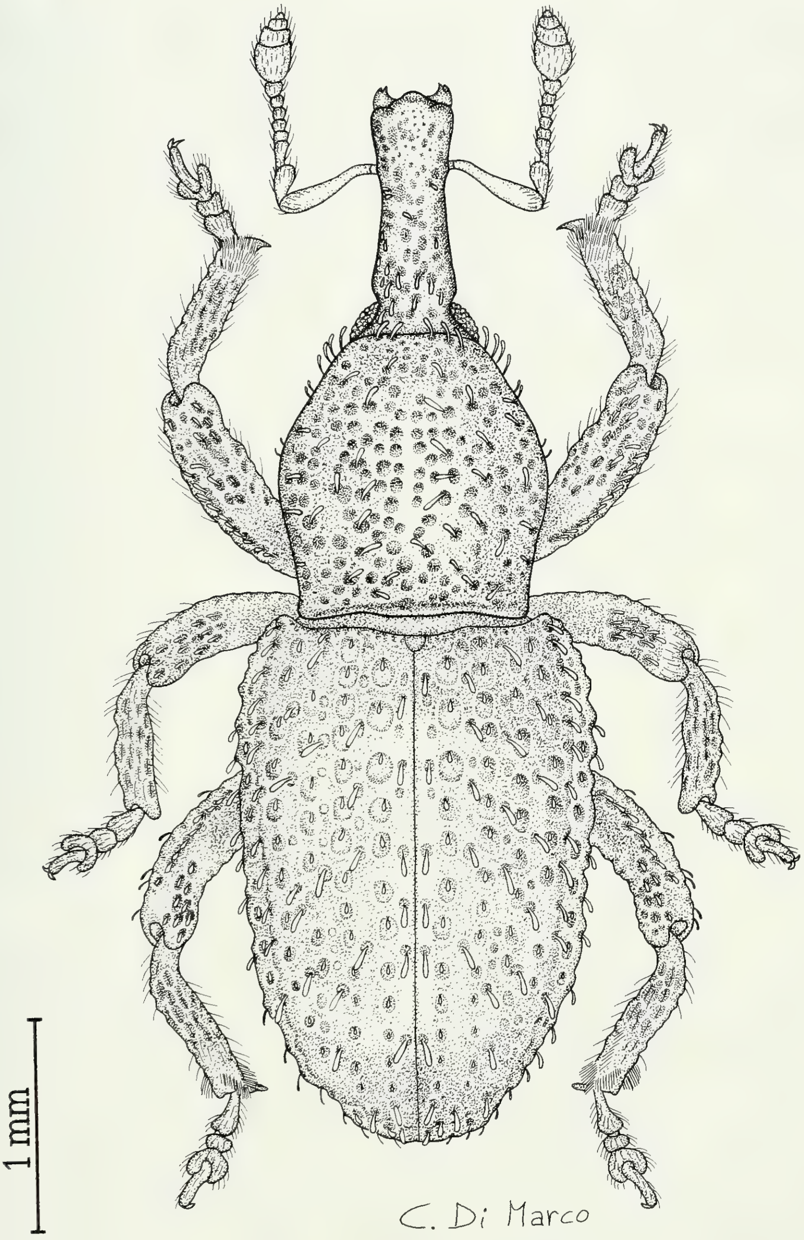


FIG. 1
Habitus di *Acallorneuma ingoi* sp. n. (Holotypus maschio): Lazio, San Donato Val Comino (FR).

renzia per le elitre parzialmente squamulate (anche in *punctaticollis* Lucas, 1849) larghe quanto il pronoto, per i femori inermi e per lo spiculum ventrale a "paletta".

Acallocrates Reitter, 1916 condivide con *Acallorneuma* le elitre più larghe del pronoto; se ne separa immediatamente per la densa squamulatura del corpo, per gli occhi subtriangolari, per il pronoto medialmente carenato con forte smarginatura basale, per lo scutello approfondito nelle elitre per le 3°, 5° e 7° interstrie careniformi, per i femori mutici, per lo spiculum ventrale e per l'edeago.

Assai più differenziati, anche per le maggiori dimensioni, sono i restanti Criptorinchini euromediterranei. *Gasterocercus* Laporté & Brullé, 1826 e *Camptorhinus* Schönherr, 1826. Infatti presentano tegumenti ricoperti di squame serrate, con gli occhi ben sviluppati con rostro lungo e diritto, e nel caso di *Camptorhinus,* anche con zampe posteriori molto allungate, peculiari.

Più evidenti ancora sono le differenze che intercorrono con *Cryptorhynchus* Illiger, 1807, il quale si differenzia da *Acallorneuma* per le dimensioni maggiori, per la vestitura squamulosa, per il corpo molto convesso, con rostro allungato, per i femori bidentati e per l'edeago. E' da sottolineare infine che *C. lapathi* (l'unica specie di questo genere paleartico orientale presente nell'area mediterranea) a differenza di altri Criptorinchini (legati al legno morto o alle piante morenti) attacca le latifoglie in pieno rigoglio.

Decisamente lontani sono invece i *Torneuma* Wollaston s. l. (nonchè *Somodytes* Gonzales) non solo per le differenze elencate nella premessa ma anche per l'ecologia e la biologia in quanto entità ipogee legate alle bulbose.

Acallorneuma reitteri Mainardi, 1906 Figg. 2a, 3a, 4a, 5d, 6a,b,c

Località tipica: Arpino (Lazio)

Mainardi, 1906: 151-156. Heyden, Reitter & Weise, 1906: 668. Solari & Solari, 1908: 276. Winkler, 1927-1932: 1593. Luigioni, 1929: 926. Porta, 1932: 192. Hustache, 1936: 96. Abbazzi & Osella, 1992: 339. Osella & Zuppa, 1993: 420-421. Abbazzi *et. al.*, 1994: 40. Osella & Zuppa, 1998: 1128.

Materiale tipico. Holotypus: 1 ex. etichettato "Arpino, 1905, A.M." (MSNM).

Materiale esaminato. Toscana, Sintigliano, Pieve Santo Stefano (AR), 2.X.1936, 1 ex., leg. Andreini (MSNF). Umbria, S. Giustino (PG), Monte Moriccio, m 900, 1.VI.1992, 1 ex., legg. Buttarelli, Pantini & Valle; Genga (AN), 10.VII.1928, 1 ex., leg. Andreini (MSNF). Emilia Romagna, Pietramora (RA), m 800, 1 ex. (Ps); San Marino, 3.X.1945, 1 maschio (terriccio Castagneto), leg. Zangheri (MNSV). Lazio, M.te Scalambra (Ernici), m 900, 23.IX.1990, 2 exx., leg. Zoia; Alvito (FR), località Valle Rio, m 700 (N-O), 14.XI.1999, 4 exx. (vaglio Ostrieto), leg. Osella; idem, 4 XII.1999, 2 exx. (muschio), leg. Di Martino; idem, 19.XII.1999, 4 exx., leg. Osella; Monte Calvo, Rocca di Corno (RI), m 1000 (N), 20.III.1999, 7 exx. (vaglio bosco misto), leg. Osella; idem, 27.III.1999, 6 exx.; idem, 2.IX.1999, 7 exx., legg. Marotta, Osella & Zuppa; idem, 28.II. 2000, 17 exx., legg. Marotta & Zuppa. Abruzzo, Gran Sasso, Colledara (TE), Santuario di San Gabriele, m 600 (N), 20.II.2000, 1 ex. (vaglio bosco misto), leg. Osella; P.N.A., Barrea (AQ), 2 Km verso Lago Vivo, m 1200, 26.IV.1999, 9 exx.(vaglio Ostrieto), leg. Osella; idem, m 1150 (N-O), 1.V.1999, 2 exx.; idem, 4.IX.1999, 1 ex. (vaglio Nocciolo); Lago di Barrea, 4 Km W Barrea, m 1000, 16.V.1998, 8 exx., leg. Wolf (IW); P.N.A., Val Fondillo (AQ), località Casone Antonucci, m 1000 (W), 26.IV.1999, 2 exx. (vaglio Querceta), leg. Osella; P.N.A., Camosciara, 8.VII/8.VIII.1982, 1 ex., leg. Petrella; idem, 18.V.1983, 2 exx.; idem, 28.VII/18.VIII.1983, 1 ex.; Pescina (AQ), inizio Valle del Giovenco, m 750 (N), 7.XI.1999, 6 exx. (vaglio, Quercia - Nocciolo), leg. Osella; idem, 16.IV.2000, 2 exx.; Carpineto della Nora (PE), 14.III.1999, m 1000, 2 exx., leg. Osella; idem,

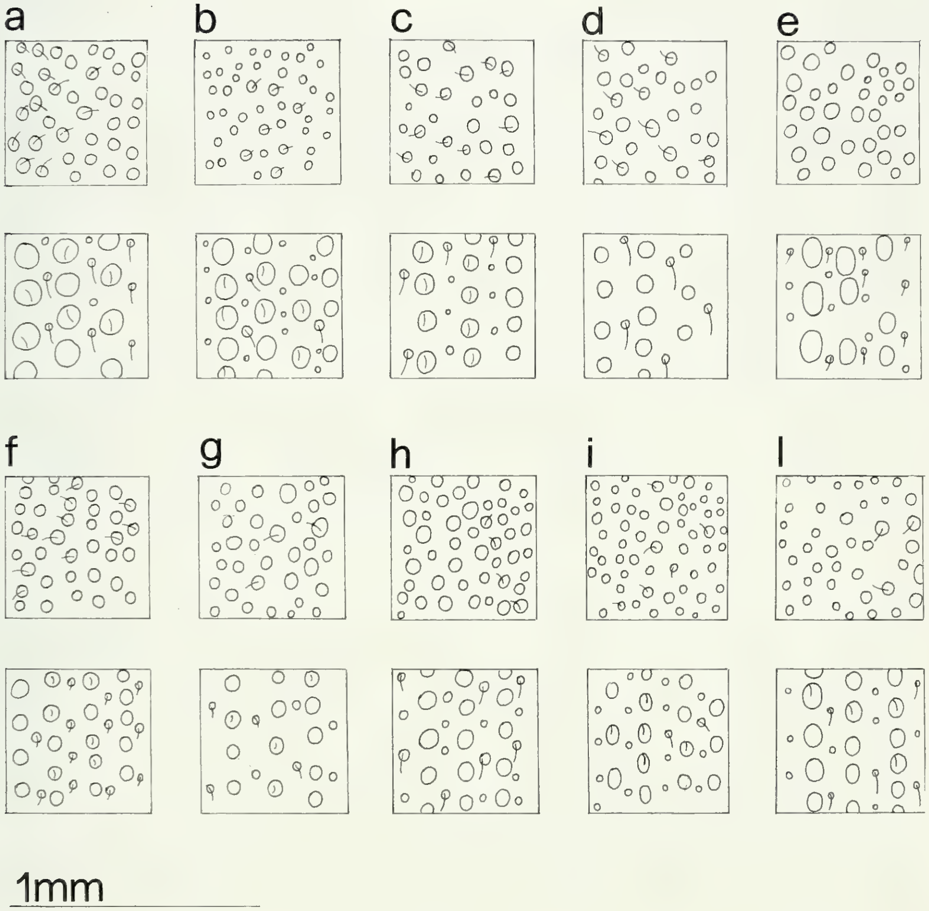


FIG. 2

Vestitura del pronoto e delle elitre di: *Acallorneuma reitteri* (Molise, Montenero Valcocchiara – IS) (a); *A. ingoi* sp. n. (Lazio, San Donato Val Comino – FR) (b); *A. doderoi* (Sicilia, Rocca Busambra – PA) (c); *A. sabellai* sp. n. (Sicilia, Erice – TP) (d); *A. peyerimhoffi* (Algeria, Guerrouch) (e); *A. montisalbi* sp. n. (Sardegna, Monte Albo – NU) (f); *A. sardiniensis* sp. n. (Sardegna, Lula – NU) (g); *A. mainardii* (Sardegna, Seui – NU) (h); *A. poggii* sp. n. (Sardegna, Dorgali – NU) (i); *A. gasparoi* sp. n. (Sardegna, Dorgali – NU)(l).

m 1000, 21.III.1999, st1, 3 exx. (vaglio bosco misto); idem, m 600 (N), 17.IV.1999, st2, 4 exx. (vaglio Ostrieto), leg. Osella; idem, N, 24.IV.1999, 1 ex., legg. Osella & Zuppa; idem, N-O, 23 exx.; idem, 16.V.1999, 4 exx., leg. Osella; idem, 6.XI.1999, 4 exx. (vaglio bosco misto), leg. Osella; idem, 28.XI.1999, 15 exx.; Sella di Corno (AQ), 19 Km W L'Aquila, m 1000, 19.V.1998, 4 exx., leg. Wolf (IW); Palena (CH), 15.VIII.1925, 1 ex., leg. Solari; Castel di Ieri (AQ), Forca Caruso, Casa Cantoniera, m 1000 (N), 25.IV.1999, 12 exx. (vaglio *Anemone apennina*), leg. Osella; idem, st1, m 1100, 9.V.1999, 9 exx. (vaglio bosco misto); idem, st2, 4 exx.; idem, 29.V.1999, 12 exx. (vaglio Nocciolo), legg. Osella & Marotta; idem, 7.IX.1999, 5 exx., legg. Marotta, Osella & Zuppa; idem, 14.X.1999, 22 exx, legg. Marotta & Osella; idem, 4 exx., 22.XI.1999, legg. Marotta & Zuppa; idem, 28.V.2000, 1 ex., leg. Osella; Goriano Sicoli

(AQ), strada per Ortona dei Marsi, Monte Lupone, m 900, 7.XI.1999, 1 ex. (vaglio Querceta), leg. Osella; Montagne del Morrone, Bagnaturo (AQ), località Colle delle Vacche, m 1174, 16.V.1999, 2 exx. (vaglio *Quercus cerris*), leg. Presutto; Salle (PE), m 700, 16.II.1998, 1 ex. (vaglio bosco misto); idem, m 550, 15.III.1997, 3 exx. (vaglio Querceta); idem, 24.IV.1998, 1 ex. (trappole); idem, 24.V.1998, 1 ex. (vaglio Querceta); idem, 10.V.1997, 1 ex.; Tocco da Casauria (PE), sentiero per Schiena d'Asino, m 500, 25.IX.1998, 1 ex. (vaglio *Acer obtusatum*); idem, m 465, 29.IX.1998, 6 exx. (vaglio bosco misto alla base di *Ostrya carpinifolia*); idem, 1 ex. (vaglio *Acer obtusatum*); Morino (AQ), Riserva Naturale Zompo lo Schioppo, 29.X.1996, 6 exx., legg. Osella & Di Marco (vaglio bosco misto); idem, La Fossa, m 700, 18.III.1997, 3 exx., legg. Di Marco & Zuppa; Castel di Sangro (AQ), S. Pietro Avellana, 19.VI.1996, 3 exx., leg. Osella; Monti a sud di Castel di Sangro (AQ), 3 exx., leg. Paganetti (coll. Dodero) (MGCD); M.te Pagano, 6 exx., leg. Paganetti (coll. Binaghi) (MGCD); idem, 2 exx. (coll. Mancini) (MGCD); idem, 2 exx. (coll. generale) (MGCD); idem, 5 exx. (coll. Luigioni) (MCZR). Molise, Montenero Valcocchiara (IS), Il Pantano, m 820, 9.X.1993, 2 exx., leg. Osella; idem, 16.X.1993, 8 exx.; idem, 5.IV.1999, 15 exx. (vaglio siepe marginale); idem, 6 exx. (MSNM); idem, 10 exx. (MHNG); idem, 6 exx. (MGCD); idem, 4 exx. (MSNV); idem, 5.IX.1999, 19 exx.; idem, 8.XII.1999, 44 exx.; Collemeluccio (Pietrabbondante) (IS), 15.IX.1993, 3 exx., leg. Osella; Vinchiaturo (CB), 15.IX.1993, 1 ex., leg. Osella. Campania, Cava dei Tirreni, 6.XI.,1 ex., Anguissola (coll. Luigioni) (MCZR). Calabria, Grisolia (CS), 28.VII.1973, 1 ex., leg. Pace; idem, 2.VIII.1973, 2 exx.; M.ti Orsomarso, Buonvicino, Serrapodolo (CS), m 4000, 12.VIII.1990, 1 ex., leg. Angelini.

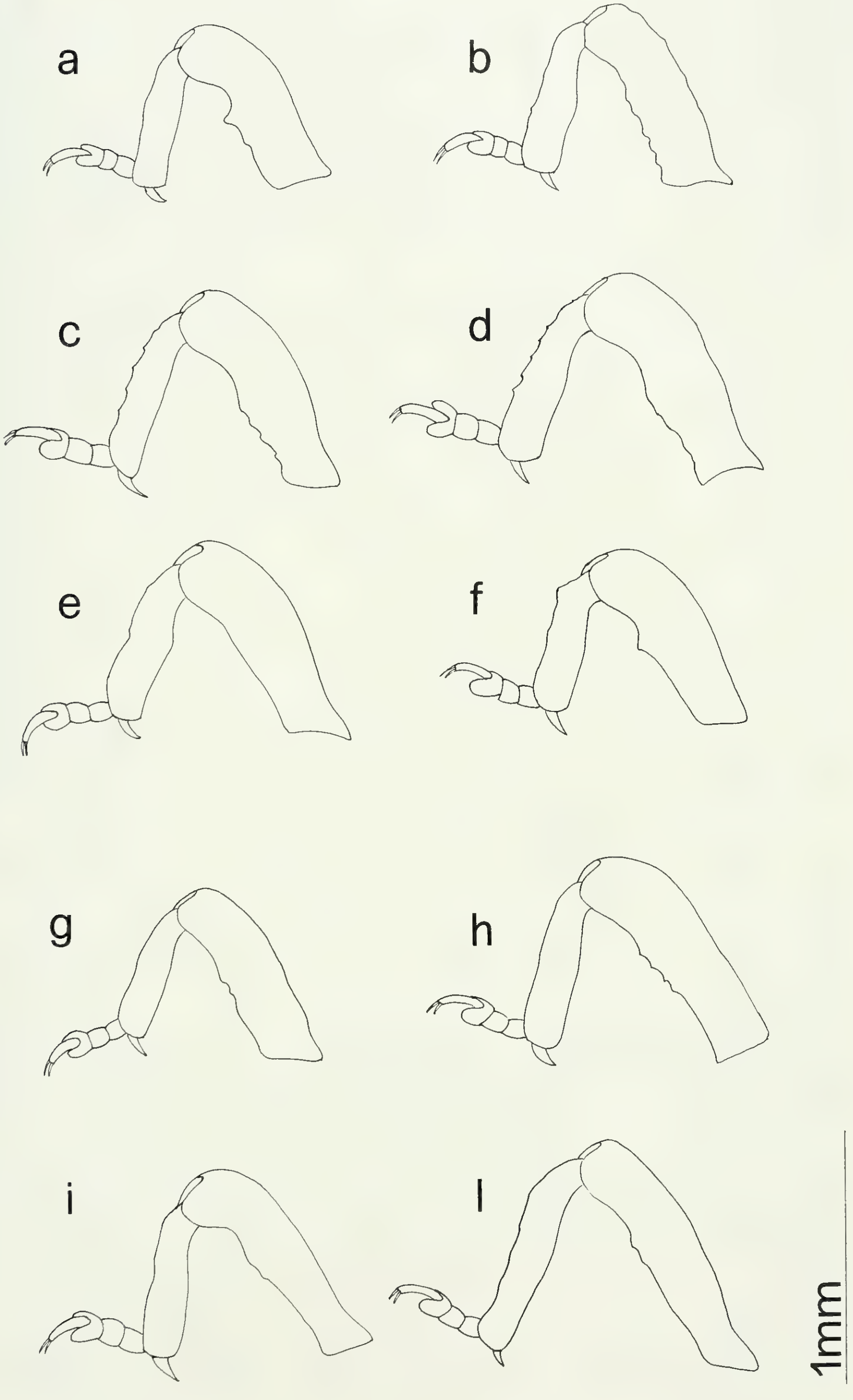
Ridescrizione. Lunghezza 2.06-3.59 mm. Corpo cilindrico-allungato, nero o rosso-bruno (esemplari immaturi) con setole brevi su capo, torace e zampe. Rostro ricurvo, a lati paralleli, strozzato alla base, subconvesso dorsalmente, striato-punteggiato, opaco tra la base e l'inserzione antennale, successivamente brillante e con punteggiatura fine e spaziata; scrobe profonde, brillanti, subparallele che raggiungono, all'indietro, gli occhi. Antenne inserite nel 1/3 apicale, robuste, rossicce, debolmente setolose; scapo, cilindrico appena ingrossato all'estremità, che non raggiunge, all'indietro, la base del rostro; funicolo con 1° articolo allungato, più robusto dei restanti, 2° pure cilindrico subeguale in lunghezza al 1°, articoli 3° e 5° subquadrati, 6° e 7° sferici; clava robusta più lunga degli ultimi tre articoli del funicolo. Capo sferico, finemente microreticolato; occhi appiattiti con 12-24 ommatidi ordinati in serie parallele.

Protorace a base rettilinea, più lungo che largo, arcuato ai lati più sensibilmente ristretto alla base che verso il capo, maggior ampiezza un po' prima della metà, lievemente carenato sul disco, con punti rotondo-ellittici separati da un'area zigrinata di larghezza variabile. Detti punti sono ordinati in serie irregolari longitudinali e provvisti di brevi setole variamente orientate, le più lunghe delle quali sul margine anteriore. Scutello piccolo, semicircolare.

Elitre oblungo-ovali, a base subsinuosa, a margine debolmente rilevato con maggiore larghezza nel 1/3 prossimale, saldate alla sutura (quest'ultima sempre ben

FIG. 3

Disegno schematico della zampa anteriore di: *Acallorneuma reitteri* (Molise, Montenero Valcocchiara – IS) (a); *A. ingoi* sp. n. (Lazio, San Donato Val Comino – FR) (b); *A. doderoi* (Sicilia, Rocca Busambra – PA) (c); *A. sabellai* sp. n. (Sicilia, Erice – TP) (d); *A. mainardii* (Sardegna, Seui – NU) (e); *A. montisalbi* sp. n. (Sardegna, Monte Albo – NU) (f); *A. poggii* sp. n. (Sardegna, Dorgali – NU) (g); *A. sardiniensis* sp. n. (Sardegna, Lula – NU) (h); *A. peyerimhoffi* (Algeria, Guerrouch) (i); *A. gasparoi* sp. n. (Sardegna, Dorgali – NU)(l).


a
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evidente), fortemente striato-punteggiate. Strie con punti grandi, profondi, rotondeggianti nella metà anteriore via via più piccoli e superficiali nella parte declive. Ogni punto è provvisto di una piccolissima setola (Fig. 2a). Interstrie meno larghe delle strie, irregolarmente punteggiate, con una piccola setola, convesse, intaccate dai punti delle strie. Le interstrie 1a e 2a raggiungono l'apice posteriore delle elitre (dove la 2a si salda con la 9a); la 3a si unisce alla 4a ed alla 6a mentre l'8a si ferma poco oltre la metà delle elitre. Le strie 1a e 5a, invece, dalla base raggiungono l'estremità posteriore; le strie 6a ed 8a, invece, iniziano dietro l'omero e si fermano prima di raggiungere la declività posteriore.

Zampe brevi, robuste, punteggiate; femori solcati inferiormente con un incavo atto a ricevere le tibie a riposo, con un dente mediano sul margine interno e con setole brevi, aderenti ai tegumenti (Fig. 3a). Femori a base leggermente sinuosa con crenellatura sul margine esterno particolarmente evidente su meso e metafemori.

Prosterno con solco profondo, semicircolare all'altezza delle coxe mediane. Metasterno con punteggiatura rotonda, ai margini con un rilievo dentiforme. Urosternite 1° largo, con punti in serie subparallele, separati da spazi zigrinati di norma di ampiezza inferiore al diametro dei punti stessi. Urosternite 2° largo circa la metà del primo, separato da quest'ultimo da una sutura non completamente obliterata, con punti di diametro inferiore a quelli del 1°, spazi tra i punti zigrinati; urosterniti 3° e 4° stretti con punteggiatura fine; urosternite 5° largo, semicircolare con punti di dimensioni e distribuzione irregolare. Edeago, spicula, spermateca ed armatura interna (Figg. 4a, 5d, 6a-b-c).

Variabilità della specie. Pur presentando una distribuzione notevolmente estesa nella Penisola italiana (Fig. 8), *A. reitteri* si presenta morfologicamente piuttosto omogeneo. Rispetto al tipo le interstrie possono essere più evidentemente careniformi (ad es. gli esemplari di Villetta Barrea) o con margine anteriore delle elitre più o meno rilevato. La quasi totalità degli individui, poi, è di color nero pece e la punteggiatura del pronoto è più o meno ordinata. Riteniamo che gli esemplari leggermente più chiari (compreso l'holotypus) siano individui neosfarfallati. Solo gli esemplari di Orsomarso (Calabria), per le dimensioni leggermente maggiori (mm 3.59 contro mm 2.06), per gli articoli 6°-7° del funicolo subquadrati anzichè sferici, per le elitre fortemente punteggiate, per gli occhi con un numero di ommatidi più ridotto (12/13 anzichè 12/24) e per la struttura dell'VIII sternite (Fig. 6c), differiscono apprezzabilmente dai restanti materiali appenninici. Tuttavia data la scarsità dei materiali studiati non ci è possibile esprimere un giudizio tassonomico in merito a queste differenze.

Dati morfometrici. Maschio: Lusc = 0.37 mm ± 0.05; Lufu = 0.41 mm ± 0.05; Lucl = 0.22 mm ± 0.02; Luro = 0.66 mm ± 0.05; Lupr = 1.12 mm ± 0.28; Luel = 1.81 mm ± 0.23; Lapr = 1.09 mm ± 0.31; Lael = 1.41 mm ± 0.16. Femmina: Lusc = 0.37 mm ± 0.03; Lufu = 0.41 mm ± 0.02; Lucl = 0.22 mm ± 0.02; Luro = 0.69 mm ± 0.05; Lupr = 1.19 mm ± 0.1; Luel = 1.94 mm ± 0.16; Lapr = 1.19 mm ± 0.08; Lael = 1.5 mm ± 0.1.

Dati di letteratura. Lazio tra Arpino e Casalvieri contrada La Faete (Mainardi, 1906); Umbria (M. Catria), Abruzzo (M. Pagano), Napoli (Cava dei Tirreni) (Luigioni, 1929); Abruzzo, Terra di Lavoro (Monti tra Arpino e Casalvieri in contrada

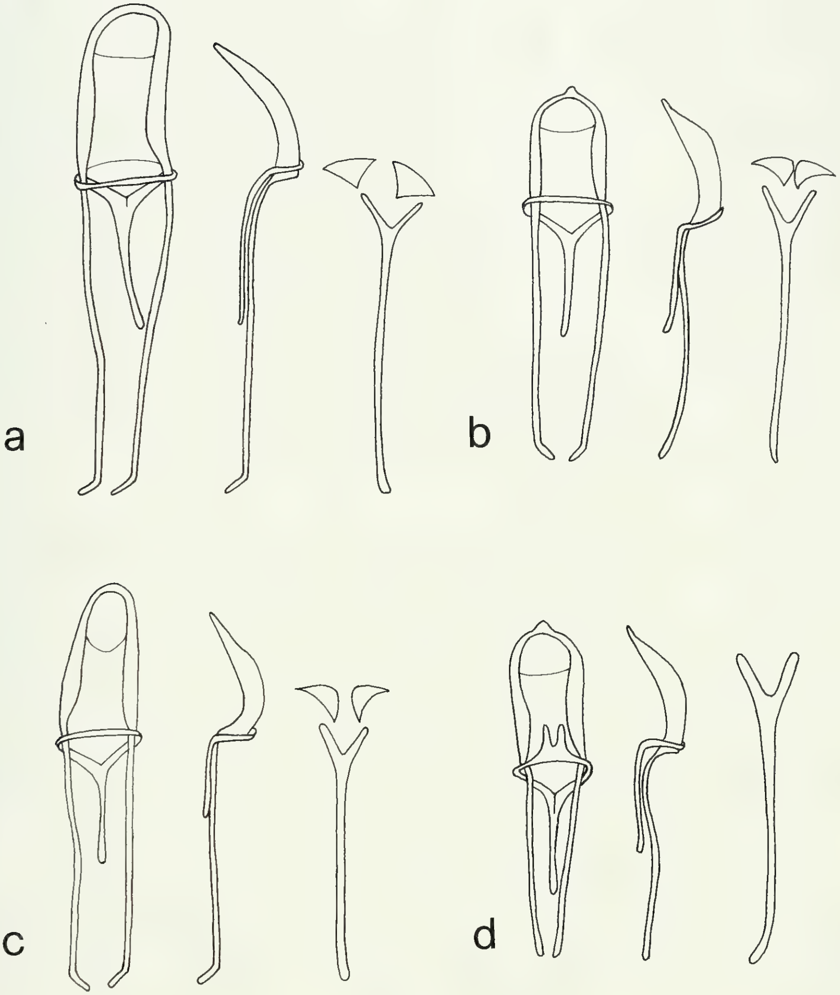

FIG. 4

Edeago (visione dorsale e laterale) e spiculum gastrale di: *Acallorneuma reitteri* (Molise, Montenero Valcocchiara – IS) (a); *A. ingoi* sp. n. (Lazio, San Donato Val Comino – FR) (b); *A. montisalbi* sp. n. (Sardegna, Monte Albo – NU) (c); *A. gasparoi* sp. n. (Sardegna, Dorgali – NU)(d).

La Faete) (Porta, 1932); Italia (Winkler, 1927-1932; Hustache, 1936); Marche, Pianella (Genga, AN), XI.1924, 1ex., leg.? (MSNM); Nocera Umbra (PG), Pendici Monte Pennino, Colle Aprico, m 700, 1.VI.1992, 1 ex., leg. Valle; Monte Catria (PS), 19.V.1907, 1 ex., leg. Mainardi (Osella & Zuppa, 1993).

Ecologia. Sull'ecologia di *A. reitteri* disponiamo solo di preliminari informazioni. Mainardi (1906) raccolse il tipo "vagliando le foglie che coprono i pendii montuosi tra i 600 e gli 800 m d'altitudine" tra Arpino e Casalvieri contrada La Faete

(Frosinone, Lazio). Osella & Zuppa (1993) la definiscono "specie tipica dei boschi misti di latifoglie con sottobosco a *Prunus* e *Crataegus* di quote comprese tra i 400 e i 900 m". Le attuali ricerche in Lazio, Abruzzo e Molise ci hanno permesso di confermare: a) che la specie predilige i boschi misti; b) che sembra nettamente prediligere i versanti N o N-O; c) che di questi ultimi colonizza soprattutto le aree ecotonali cespugliate o alberate a *Corylus avellana* L., *Acer campestre* L., *A. obtusatum* Waldst. & Kit., *Ostrya carpinifolia* Scop., *Fraxinus* sp., *Crataegus monogyna* Jacq., *Prunus spinosa* L., *Quercus* sp. ecc. con vegetazione di sottobosco dominata da entità schiettamente nemorali quali *Daphne laureola* L., *Cyclamen purpurascens* Mill., *Primula vulgaris* Huds., *Scilla bifolia* L., *Eranthis hiemalis* (L.) Salisb., *Coridalis* cfr. *cava*, *Anemone ranunculoides* L., *Anemone apennina* L. ecc. Gli esemplari vivono nell'humus di cespugli o alla base di alberi, con lettiera di 5-10 cm. Tra i Curculionoidea che costantemente si accompagnano a questo *Acallorneuma* abbiamo: *Phaenotherion fasciculatum* Reitter, 1891, *Aparopion chevrolati* J. du Val, 1868, *Echinodera brisouti* Reitter, 1885, *Echinodera capiomonti* Brisout, 1864, *Acalles lemur* Germar, 1824, *Acalles commutatus* Dieckmann, 1982, *Acalles parvulus* Bohemann, 1837, *Acalles roboris* Curtis, 1834 e *Ruteria hypocrita* Bohemann, 1837. Frequenti sono pure *Dodechasticus consentaneus latialis* Solari & Solari, 1915, *Otiorhynchus lutosus* Stierlin, 1858, *O. crataegi* Germar, 1824, *Brachysomus hirtus* Boheman, 1845; rari invece gli *Otiorhynchus* del sottogenere *Lixorhynchus*, nonchè *Echinomorphus ravouxi* (Jaquet, 1888) e *Orthochaetes setiger* (Beck, 1817). Tra i Coleotteri Pselaphidae abbiamo: *Bryaxis pedator* (Reitter, 1881), *Brachygluta perforata* (Aubè, 1833) e *Trimium brevicorne* Aubè, 1833, mentre tra i Cholevidae abbiamo: *Nargus velox* (Spence, 1815), *Nargus badius* (Sturm, 1839), *Ptomaphagus pius* Seidlitz, 1887 e *Bathysciola* cfr. *clavicornis* Jeannel, 1924.

Per quanto riguarda il rapporto sessi, esso è all'incirca 1:1 pressochè in tutte le stazioni esaminate.

Biologia. Sconosciuta. Date tuttavia le caratteristiche morfoecologiche, è verosimile che si tratti di un'entità xilosaprofaga, ma è probabile altresì che tale discorso valga per tutte le specie del genere. L'adulto è stato raccolto durante tutto l'anno (Tab. 1). In base al colore più o meno rossiccio di alcuni esemplari (ad esempio quelli di Palena), raccolti nel mese di agosto si può ipotizzare che questo sia il periodo di sfarfallamento delle immagini. E' nostra opinione, tuttavia, che il periodo di sfarfallamento, nonchè la durata della vita immaginale, sia piuttosto lungo anche in relazione alle condizioni ecologiche ed ambientali generali e locali. L'immagine è molto lenta nei suoi movimenti e l'allevamento in laboratorio presenta difficoltà notevoli.

Distribuzione geografica. *A. reitteri* è la specie del genere a più ampia distribuzione che si conosca essendo presente dall'Appennino tosco-emiliano alla Calabria. In Abruzzo e Molise è abbastanza diffusa nelle località forestali interne in buone condizioni di conservazione a quote comprese tra 500 e 1200 m, pur prediligendo le località tra 700 ed 1000 m.

Acallorneuma ingoi sp. n. Figg. 1, 2a, 3b, 4b, 6d

Località tipica: San Donato Val Comino (Lazio)

Materiale tipico. Holotypus: 1 ex. etichettato " Lazio, 50 Km N Monte Cassino (= San Donato Val Comino), Passo di Forca d'Acero, 15.V.1998, leg. Wolf" (MNHG); paratipi: Lazio, M.ti Lepini, Carpineto Romano (RM), la Faggeta, m 900, 30.X.1995, 1 ex., leg. Osella; Colli Albani, Rocca di Papa (RM), M.te Cavo, m 600-800, 9.V.1998, 1 ex., leg. Wolf (IW); Monte Cassino (= San Donato Val Comino) (FR), am Gelände der Terme Varroniane, 10.V.1998, 2 exx, leg. Wolf (IW); idem, 50 Km N Monte Cassino, Passo di Forca d'Acero, 15.V.1998, 14 exx. (IW); idem, 2 exx. (MSNM); idem, 1 ex. (MGCD); idem, 1 ex. (MSNV); Alvito (FR), località Valle Rio, m 700 (N-O), 14.XI.1999, 1 ex. (vaglio Ostrieto-Querceto), leg. Osella; idem, 4.XII.1999, 2 exx., leg. Di Martino (muschio); idem, 2 exx. (MRSN); idem, 19.XII.1999, 3 exx., leg. Osella (vaglio *Acer-Corylus*); idem, 3 exx. (MHNG); idem, 1 ex. (MRSN); idem, 2 exx., leg. Osella (vaglio Querceta); idem, 4.XII.1999, 3 exx., leg. Osella (Ostrieto-Querceto) (MGCD); idem, 19.XII.1999, 1 ex., leg. Osella; idem, 8.IV.2000, 3 exx., leg. Osella; idem, 10.IX.2000, 3 exx., leg. Osella; idem, 2 exx. (MSNV); San Donato Val Comino (FR), m 800 (S-O), 14.XI.1999, 2 exx., leg. Osella (vaglio Ostrieto); idem, 4.XII.1999, 3 exx., leg. Di Martino (vaglio Ostrieto-Querceto) (MHNG); idem, 1 ex., leg. Osella; Gori, Grotta Catauso (FR), 5 exx., 1953, leg. Colonnelli (INE). Campania, Monti del Matese a Nord di Letino (CE), m 935, 28.V.1999, 1 ex., leg. Meregalli (Mer).

Diagnosi. Lunghezza 3.09-4.03 mm. A motivo dei femori con 5 piccoli dentelli la nuova specie è facilmente distinguibile da *A. reitteri* con il quale convive ad Alvito (FR) località Valle Rio (Figg. 3a-b). Si differenzia altresì per le minori dimensioni, per la diversa conformazione delle strutture genitali e per la sutura tra 1° e 2° urosternite completamente obliterata.

Descrizione dell'holotypus maschio. Bruno-nero con antenne, tarsi e zampe più chiare. Corpo cilindrico, allungato con elitre variolosamente punteggiate sul disco. Rostro subcilindrico, a lati paralleli, ricurvo, rosso bruno, striato punteggiato (più fortemente tra capo ed antenne); scrobe lucide e profonde che raggiungono, all'indietro, gli occhi. Capo globoso, occhi ovali, piatti, con 14 ommatidi disposti su quattro file (rispettivamente 3, 4, 4 e 3 ommatidi per fila).

Pronoto più lungo che largo, fittamente ma superficialmente punteggiato, con punti più evidenti sul disco e sul margine anteriore rispetto ai lati, con carena mediana obsoleta. Scutello semicircolare.

Strie più larghe delle interstrie, con i primi 8 punti molto grandi, rotondi che intaccano il margine della stria; successivamente, all'inizio della declività e fino al termine dell'elitra, abbiamo altri 8 punti via via più piccoli e superficiali ognuno con una minuscola setola. Interstrie punteggiate con setole rilevate, leggermente più lunghe che in *A. reitteri* (Fig. 2b).

Zampe robuste, rosso brune leggermente setolose; femori con un incavo superficiale sul lato inferiore, esteso per tutta la lunghezza del femore, con margine interno rilevato, con 5 piccoli rilievi dentiformi (Fig. 3b).

Solco prosternale, e coxe come in *A. reitteri*; mesosterno leggermente infossato. Urosterniti 1° e 2° leggermente incavati medialmente con sutura obsoleta, con punti grandi, rotondi, profondi, ordinati in linee subregolari. Edeago, spicula e spermateca: Figg. 4b, 6d.

Descrizione dei paratipi maschi e femmine. La femmina è distinguibile solo per gli urosterniti 1° e 2° piani. Tutti i paratipi maschi e femmine sono pressochè indistinguibili dal tipo. Solo l'esemplare dei Colli Albani, si differenzia per il pronoto e le strie elitrali con punteggiatura più superficiale.

Dati morfometrici. Maschio: Lusc = 0.34 mm ± 0.02; Lufu = 0.37 mm ± 0.02; Lucl = 0.22 mm ± 0.02; Luro = 0.62 mm ± 0.04; Lupr = 1.06 mm ± 0.08; Luel = 1.72 mm ± 0.16; Lapr = 0.94 mm ± 0.26; Lael = 1.25 mm ± 0.09. Femmina: Lusc = 0.37 mm ± 0.01; Lufu = 0.41 mm ± 0.02; Lucl = 0.22 mm ± 0.02; Luro = 0.69 mm ± 0.03; Lupr = 1.12 mm ± 0.05; Luel = 1.87 mm ± 0.13; Lapr = 1.06 mm ± 0.29; Lael = 1.41 mm ± 0.09.

Derivatio nominis. Abbiamo il piacere di dedicare questa specie al signor Ingo Wolf (Bad Endorf, Germania) che ha raccolto la prima importante serie di esemplari di questa specie.

Ecologia. L'ecologia della nuova specie è largamente sovrapponibile con quella di *A. reitteri* (con il quale, tuttavia, è stata ritrovata in simpatria solo ad Alvito (FR) località Valle Rio). Sembra tuttavia entità più termofila di quest'ultima, almeno in base alle quote delle località studiate. Le raccolte sono state effettuate vagliando il terriccio raccolto alla base degli alberi e/o nel fitto dei cespugli prevalentemente in aree ecotonali tra i 200 ed i 900 m, con suolo ricoperto di *Hedera helix.*

Biologia. Sconosciuta.

Distribuzione geografica. Benchè le ricerche di campo siano ancora insufficientemente estese, i dati disponibili indicano una sua presenza limitata al versante laziale dell'Appennino Centrale. Non è mai stata infatti ritrovata, infatti, nel confinante Appennino abruzzese.

Acallorneuma doderoi A. & F. Solari, 1908 Figg. 2c, 3c, 5c, 6e

Località tipica: Ficuzza (Sicilia)

Solari & Solari, 1908: 275. Luigioni & Tirelli, 1912: 162. Winkler, 1927-1932: 1593. Luigioni, 1929: 926. Porta, 1932: 192. Hustache, 1936: 96. Abbazzi & Osella, 1992: 339. Osella & Zuppa, 1993: 420-421. Abbazzi *et al.*, 1994: 40. Sparacio, 1999: 155.

Materiale tipico. Holotypus: 1 femmina etichettata "Ficuzza, 15-18.V.1911, L.T." (coll. Solari MSNM).

Materiale esaminato. Ficuzza, 19-27.V.1906, 1 femmina, leg. A. Dodero (coll. Dodero MGCD); idem, 15-18.V.1911, 1 femmina, L. T. (coll. Luigioni MCZR); Rocca Busambra (PA), m 1613, 18.V.1985, 3 femmine, 1 maschio, leg. Sabella (Sab); idem, 1 femmina (MHNG).

Ridescrizione. Lunghezza: 3.31-4.28 mm. Rosso bruno, debolmente brillante, corpo ovale-allungato, torace, elitre e zampe punteggiate. Punteggiatura del pronoto superficiale, relativamente spaziata, con brevi setole inserite nei punti e con carena mediana evidente. Rostro a lati subparalleli, ricurvo, dorsalmente punteggiato con punti superficiali, con carena mediana tra fronte ed inserzione delle antenne, liscia, brillante. Antenne moderatamente robuste, rossicce, funicolo e clava debolmente setolosi, primi due articoli allungati ma 1° più robusto e più lungo del 2°; 3°-6° equilunghi, di ugual dimensioni, 7° debolmente transverso; clava molto grande con 1° articolo lungo circa i 3/5 dell'intera clava. Occhi subsferici, con 17 ommatidi ordinati in tre file parallele.

Protorace più lungo che largo con maggior ampiezza nel 1/3, subrettilineo alla base. Sul disco è presente una linea mediana liscia. Scutello subtriangolare.

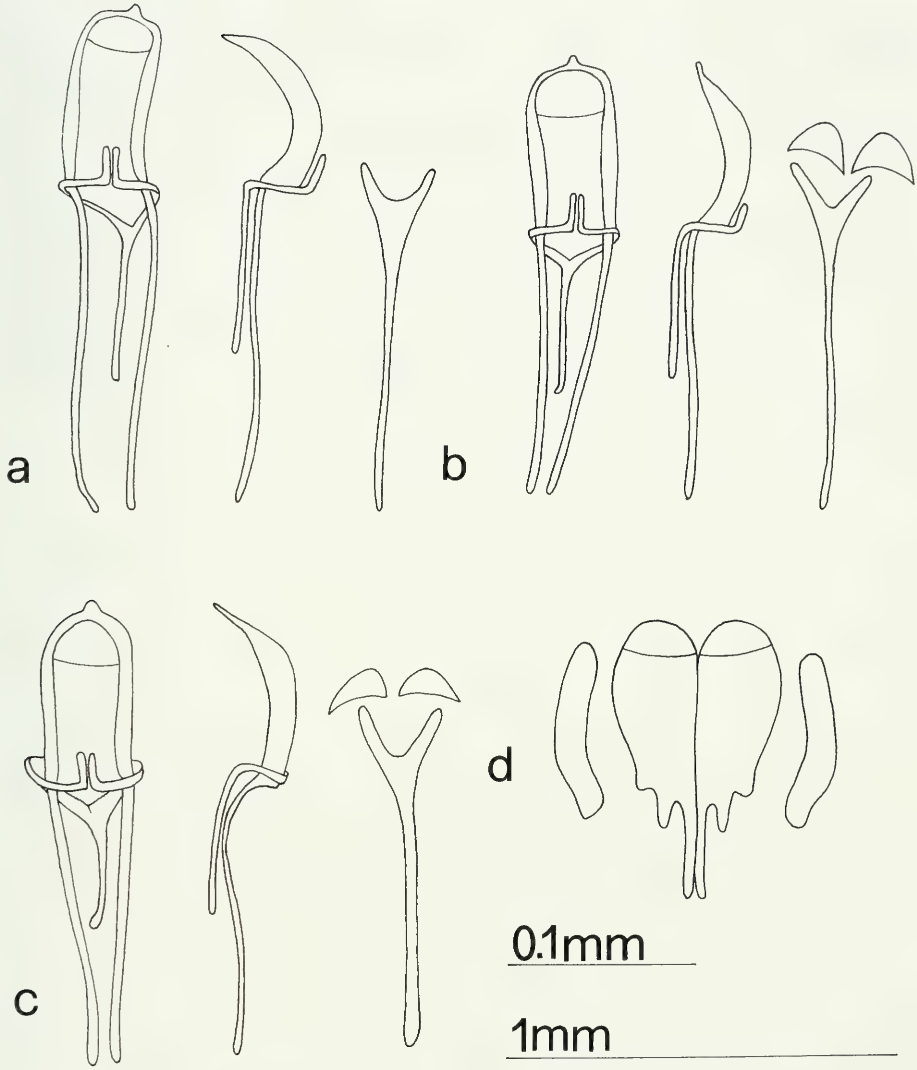

FIG. 5

Edeago (visione dorsale e laterale) e spiculum gastrale di: *Acallorneuma mainardii* (Sardegna, Seui – NU) (a); *A. sardiniensis* sp. n. (Sardegna, Lula – NU) (b); *A. doderoi* (Sicilia, Rocca Busambra – PA) (c) (scala 1 mm). Struttura del sacco interno dell'edeago di *A. reitteri* (Molise, Montenero Valcocchiara – IS) (d) (scala 0.1 mm).

Elitre ovali allungate, curvilinee, massima ampiezza appena dietro la base, saldate alla sutura, strie meno larghe delle interstrie, punteggiate, con punti rotondi, in numero di 13/14 tra la base e l'estremità declive, provvisti di una piccola setola. Interstrie brillanti subpiane a superficie irregolare con punti più grandi con setole reclinate intervallati da 2-3 punti più piccoli sprovvisti di setole (Fig. 2 c).

Zampe robuste con femori inferiormente provvisti di un accenno di solco, crenellati sul margine interno. Tibie con margine esterno con evidente crenellatura (Fig. 3 c). Edeago, spicula e spermateca: Figg. 5c, 6e.

L'esemplare maschio di Rocca Busambra, l'unico sinora conosciuto per questa specie, ci ha permesso di compilare la diagnosi del taxon.

Dati morfometrici. Femmina: Lusc = 0.34 mm ± 0.02; Lufu = 0.44 mm ± 0.06; Lucl = 0.19 mm ± 0.04; Luro = 0.75 mm; Lupr = 1.22 mm; Luel = 2.03 mm ± 0.2; Lapr = 1.12 mm ± 0.05; Lael = 1.56 mm ± 0.02. Maschio: Lusc = 0.37 mm; Lufu = 0.47 mm; Lucl = 0.22 mm; Luro = 0.75 mm; Lupr = 1.16 mm; Luel = 2.06 mm; Lapr = 1.12 mm; Lael = 1.5 mm.

Dati di letteratura. Sicilia (Winkler, 1927-1932; Luigioni, 1929; Hustache, 1936); Sicilia (Ficuzza) (Porta, 1932); Ficuzza (Sicilia), V.1906, 1 ex., leg. A. Dodero (Solari & Solari, 1908); Ficuzza, Monte Busambra, 16.V.1912, 1 ex., legg. Luigioni & Tirelli (Luigioni & Tirelli, 1912).

Note comparative. A. doderoi si avvicina soprattutto ad *A. sabellai* da cui è separato per i caratteri elencati nella descrizione di quest'ultimo.

Ecologia e biologia. Sconosciute.

Distribuzione geografica. Probabile endemita dell'area di Ficuzza e di Rocca Busambra.

Acallorneuma sabellai sp. n. Figg. 2d, 3d, 6f

Località tipica: Erice (Sicilia)

Materiale tipico. Holotypus: 1 femmina etichettata "Sicilia, Erice (TP), 3.III.1994, lecceta, leg. Sabella" (MSNV).

Diagnosi. Lunghezza 4.16 mm. Vicina ad *A. doderoi*, separabile per il pronoto più fortemente arrotondato anteriormente e leggermente infossato sul disco, per i punti delle strie elitrali sprovvisti di setole, per le interstrie elitrali piane, opache, con punti piccolissimi dai quali sorge una setola evidente, semirilevata (Figg. 2c, 2d) e per lo spiculum ventrale (Figg. 6e, 6f).

Descrizione dell'holotypus femmina. Alla diagnosi possiamo aggiungere: colore dei tegumenti bruno-nero, non brillante; capo subsferico con debole punteggiatura; carene dorsali del rostro lisce punteggiate superficialmente; scrobe lucide, ampiamente allargate all'indietro. Funicolo ad articoli 3°-7° compatti, clava più robusta che in *A. doderoi*. Urosterniti 1°-2° con punteggiatura forte, rotonda con brevi setole, con sutura evidente. Spiculum ventrale e spermateca (Fig. 6f).

Dati morfometrici. Femmina: Lusc = 0.40 mm; Lufu = 0.44 mm; Lucl = 0.22 mm; Luro = 0.69 mm; Lupr = 1.22 mm; Luel = 2.25 mm; Lapr = 1.22 mm; Lael = 1.56 mm.

Derivatio nominis. Dedichiamo con piacere questa specie al suo scopritore, il dottor Giorgio Sabella dell'Università di Catania, specialista di Coleoptera Pselaphidae appenninici.

Ecologia. L'olotipo è stato raccolto, insieme ad altri Coleotteri endogei soprattutto Pselafidi, alle pendici del Monte San Giuliano all'interno di un lembo di lecceta sotto un grande masso interrato. E' possibile che *A. sabellai*, in ambienti aridi,

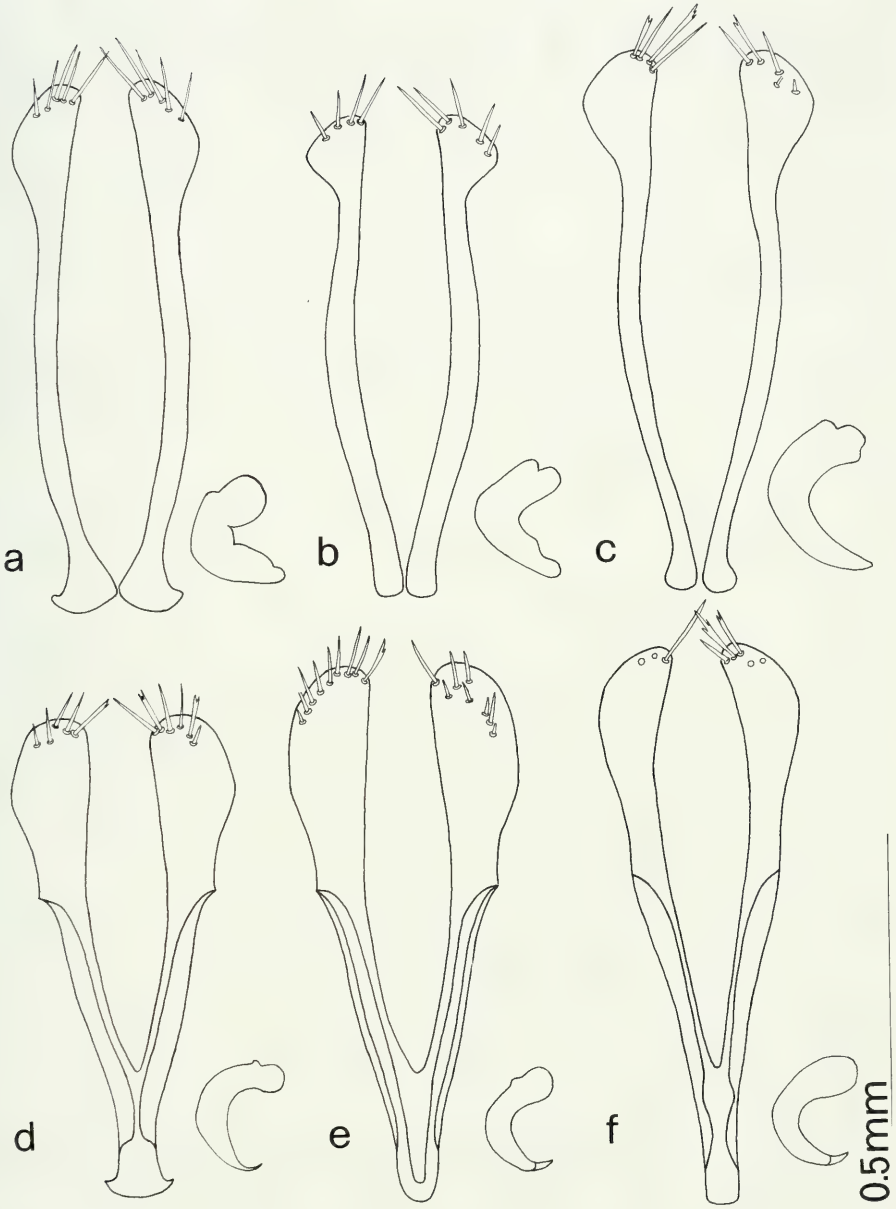

FIG. 6

Spiculum ventrale e spermateca di: *Acallorneuma reitteri* (Molise, Montenero Valcocchiara – IS) (a); *A. reitteri* (Calabria, Grisolia – CS) (b); *A. reitteri* (Calabria, Monti Orsomarso – CS) (c); *A. ingoi* sp. n. (Lazio, San Donato Val Comino – FR) (d); *A. doderoi* (Sicilia, Rocca Busambra – PA) (e); *A. sabellai* sp. n. (Sicilia, Erice – TP) (f).

mediterranei, sopravviva infossandosi nel suolo nei periodi più caldi dell'estate. Morfologicamente, tuttavia, non presenta alcun particolare carattere adattativo alla vita del suolo profondo più spiccato che negli altri *Acallorneuma* (ad eccezione di *A. gasparoi* n. sp.) (vedi).

Biologia. Sconosciuta.

Distribuzione geografica. Probabile endemita dei rilievi collinari dei dintorni di Erice.

Acallorneuma mainardii A. & F. Solari, 1908 Figg. 2h, 3e, 5a, 7a

Località tipica: Seui (Sardegna)

Solari & Solari, 1908: 275. Winkler, 1927-1932: 1593. Luigioni, 1929: 926. Porta, 1932: 192. Hustache, 1936: 96. Abbazzi & Osella, 1992: 339. Osella & Zuppa, 1993: 420-421. Abbazzi *et al.*, 1994: 40.

Materiale tipico. Holotypus: 1 femmina etichettata "Seui, 7.V.1902, leg. A. Dodero" (MSNM); paratypus: 1 maschio etichettato "Seui, presso la cantoniera di Arqueri, 7.V.1902, leg. Dodero" (coll. Dodero MGCD).

Ridescrizione. Lunghezza 4.06 mm. Corpo ovale allungato, rosso bruno, debolmente brillante con capo, pronoto ed elitre densamente punteggiate; femori non dentati; antenne, tarsi ed apice del rostro rossicci. Capo globoso immerso nel protorace; occhi subsferici, appiattiti, con 12 ommatidi. Rostro separato dal capo dalla strozzatura basale, a lati subparalleli, fortemente punteggiato tra la base e l'inserzione delle antenne, poi liscio, brillante, con punteggiatura svanita, dorsalmente tricarenato dalla base all'inserzione antennale. Scrobe profonde, subparallele, appena allargate all'altezza dell'occhio. Funicolo a 1° articolo allungato, subconico, setoloso all'apice; 2° articolo anch'esso allungato ma più breve del 1°; 3° e 4° appena più lunghi che larghi; 5° sferico, 6° e 7° trasversi; clava molto grande, oblungo-conica, debolmente setolosa con 1° articolo lungo circa 2/3 dell'intera clava.

Protorace a base rettilinea, più lungo che largo, regolarmente arrotondato ai lati, maggiore ampiezza ai 2/3 dalla base, fortemente punteggiato con punti rotondi, subvariolosi, con breve setola, spazi tra i punti zigrinati di larghezza inferiore al diametro dei punti stessi; disco con carena mediana obsoleta. Scutello incospicuo.

Elitre a base subrettilinea, oblungo-ovali, sutura saldata ma evidente, massima ampiezza nel 1/4 basale, strie appena più larghe delle interstrie, ognuna delle quali con 12/13 punti tra di loro separati da uno spazio piano di grandezza crescente dalla base verso la declività posteriore. Interstrie piane, punteggiato-zigrinate con setole presenti in genere nei punti alterni (Fig. 2h).

Zampe robuste, a margini esterni non dentellati, profemori inermi, inferiormente leggermente incavati (Fig. 3e). Tarsi come in *A. doderoi* ma 3° articolo più largamente bilobo.

Urosternite 1° due volte più largo del 2°, infossato medialmente, con sutura obsoleta, con punti profondi, rotondi, ordinatamente disposti ai lati, irregolari sul disco; urosternite 2° con punti di diametro inferiore rispetto a quelli del 1° urosternite; urosterniti 3° e 4° stretti, setolosi; 5° subtriangolare con punteggiatura simile a quella del 2°. Edeago, spicula e spermateca: Figg. 5a, 7a.

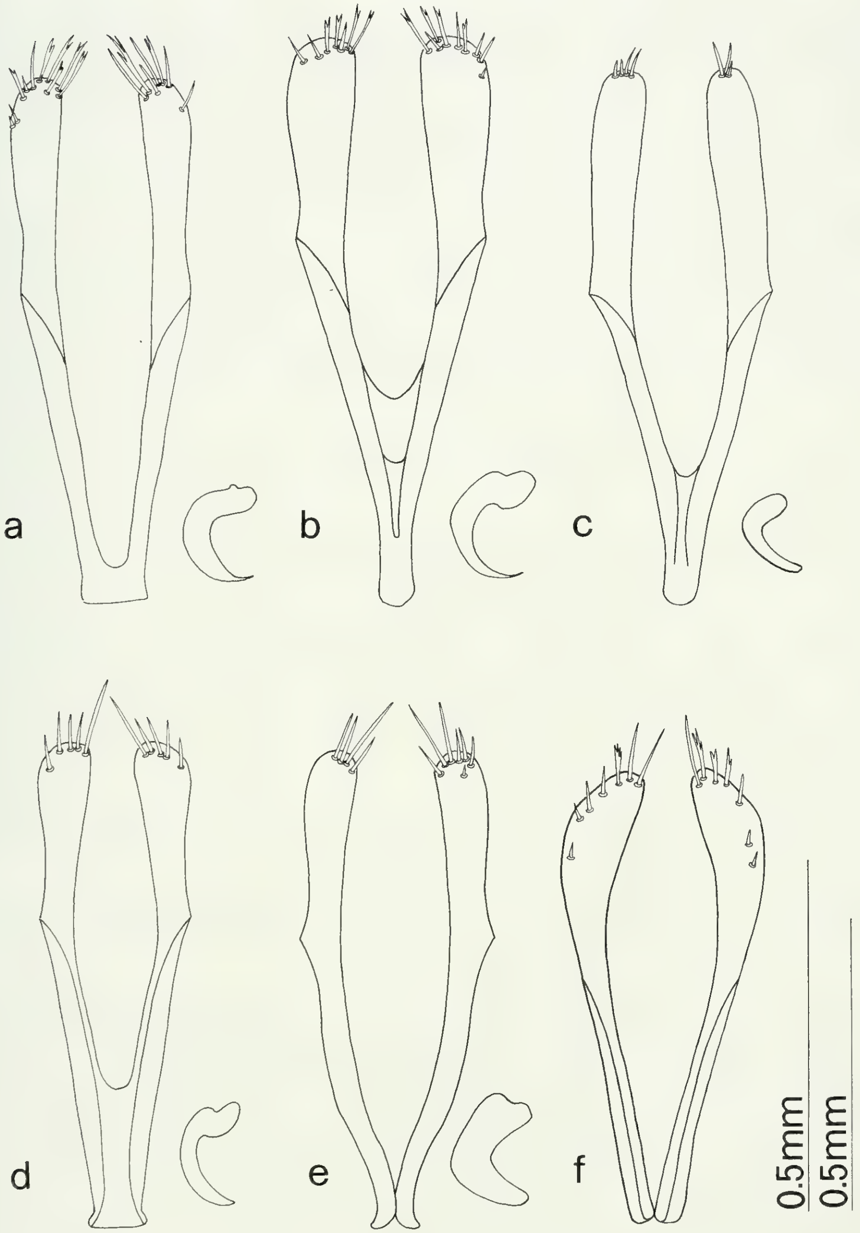

FIG. 7

Spiculum ventrale e spermateca di: *Acallorneuma mainardii* (Sardegna, Seui – NU) (a); *A. sardiniensis* sp. n. (Sardegna, Lula – NU) (b); *A. gasparoi* sp. n. (Sardegna, Dorgali – NU)(c); *A. poggii* sp. n. (Sardegna, Dorgali – NU) (d); *A. montisalbi* sp. n. (Sardegna, Lula – NU) (e); *A. peyerimhoffi* (Algeria, Guerrouch) (f).

Variabilità della specie. Il maschio è praticamente indistinguibile dalle femmine tranne per la carena mediana del pronoto meno evidente. Avviciniamo a questa specie un esemplare femmina (coll. Binaghi MGCD) etichettato "Sardinia, Arqueri, V. 1902, U. Lostia", che si differenzia dal typus per una leggera carena mediana sul pronoto e per lo spiculum ventrale un po' più allungato, a lamine laterali più lungamente saldate alla base e leggermente più espanse distalmente.

Dati morfometrici. Maschio: Lusc = 0.41 mm; Lufu = 0.44 mm; Lucl = 0.25 mm; Luro = 0.75 mm; Lupr = 1.19 mm; Luel = 2.12 mm; Lapr = 1.12 mm; Lael = 1.44 mm. Femmina: Lusc = 0.37 mm; Lufu = 0.41 mm; Lucl = 0.22 mm; Luro = 0.69 mm; Lupr = 1.12 mm; Luel = 2.12 mm; Lapr = 1.09 mm; Lael = 1.41 mm.

Dati di letteratura. Sardegna (Winkler, 1927-1932; Luigioni, 1929; Hustache, 1936); Sardegna centrale (Seui), 7.V.1902, 2 exx., leg. A. Dodero (Solari & Solari, 1908); Sardegna centrale (Seui) (Luigioni, 1929; Porta, 1932).

Note comparative. Limitatamente alle specie sarde *A. mainardii* si differenzia da *A. sardiniensis* per le interstrie elitrali meno larghe delle strie (nettamente più strette in *sardiniensis*) e per l'edeago meno corto e robusto. Da *A. poggii* si differenzia per il pronoto meno lungo e più largo con punteggiatura un po' più marcata e per lo spiculum ventrale. Nette sono invece le differenze con *A. montisalbi* per i femori dentati e per l'edeago (Figg. 3e,3f, 4c, 5a).

Ecologia e biologia. Nessuna informazione è disponibile sull'ecologia e sulla biologia della specie. E' tuttavia verosimile che la specie sia stata raccolta in lecceta dato che questo tipo di bosco domina nei dintorni di Seui e della Cantoniera d'Arqueri.

Distribuzione geografica. La specie è verosimilmente limitata alla Sardegna centrale.

Acallorneuma montisalbi sp. n. Figg. 2f, 3f, 4c, 7e

Località tipica: Lula, Monte Albo (Sardegna)

Materiale tipico. Holotypus: 1 maschio etichettato "Monte Albo, Sard., 10.III.1912" (MGCD). Paratypus: 1 maschio stessa dicitura; 1 femmina etichettata "Lula, Sard., V.1929, A. Dodero" (coll. Mancini MGCD).

Diagnosi. Lunghezza 3.72-3.97 mm. Per dimensioni, colore, pronoto con carena mediana leggera, femori dentati ed apice dell'edeago arrotondato, si avvicina ad *A. reitteri*. Se ne separa agevolmente per il pronoto a punteggiatura più variolosa, per le strie elitrali a punteggiatura meno evidente, per le interstrie piane, più larghe delle strie con setole brevi e reclinate (più lunghe e semirilevate in *A. reitteri*) (Figg. 2a, 2f); per la clava, per il dente femorale meno evidente (Figg. 3a, 3f) e, soprattutto, per la diversa conformazione dell'edeago (Figg. 4a, 4c).

Descrizione dell'holotypus maschio. Alla diagnosi sopra riportata possiamo aggiungere: tegumenti rosso-bruni, leggermente brillanti, fortemente punteggiati dalla base all'inserzione delle antenne, apicalmente brillante con punteggiatura superficiale e spaziata. Occhi con 18 ommatidi. Scutello subtriangolare. Elitre a base sinuosa con sutura obsoleta, strie meno larghe delle interstrie, con 19/20 punti setigeri, ognuno dei quali con setola reclinata (Fig. 2f). Canale rostrale leggermente svasato anteriormente. Coxe mediane più avvicinate di quanto non si osservi per le coxe anteriori; coxe metatoraciche separate da uno spazio pari a circa 3.5 volte di quello che separa le mediane. Urosterniti variolosamente punteggiati. Urosternite 1° più largo del 2°, con sutura evidente. Edeago, spicula e spermateca: Figg. 4c, 7e.

Variabilità della specie. Il paratypus maschio differisce dall'holotypus per le interstrie pari di larghezza quasi uguale a quella delle interstrie impari.

Dati morfometrici. Maschio: Lusc = 0.37 mm ± 0.02; Lufu = 0.41 mm ± 0.03; Lucl = 0.22 mm ± 0.02; Luro = 0.69 mm; Lupr = 1.19 mm ± 0.09; Luel = 2.09 mm ± 0.09; Lapr = 1.16 mm ± 0.07; Lael = 1.5 mm ± 0.09. Femmina: Lusc = 0.37 mm; Lufu = 0.41 mm; Lucl = 0.22 mm; Luro = 0.72 mm; Lupr = 1.16 mm; Luel = 2.16 mm; Lapr = 1.12 mm; Lael = 1.5 mm.

Derivatio nominis. Dal Monte Albo (Nuoro), catena calcarea ad orientamento N-E, S-O lunga 21 Km e larga 5 Km che si estende da Siniscola a Lula e che raggiunge, con Punta Santa Caterina, i 1127 m di quota (Ginesu, 1993). Circa le caratteristiche vegetazionali e faunistiche cfr. Camarda (1993) e Prota (1993).

Note comparative. Dalle altre specie sarde (*A. mainardii*, *A. sardiniensis*, *A. poggii, A. gasparoi*) *A. montisalbi* si separa per l'evidente dente femorale e per la struttura degli apparati genitali.

Ecologia e biologia. Nessuna informazione è disponibile sull'ecologia e sulla biologia della specie. Riteniamo tuttavia che la specie sia stata raccolta nei valloncelli basali di Monte Albo, dove si conservano lembi dell'originaria foresta mediterranea a *Quercus ilex*.

Distribuzione geografica. Probabile endemismo del Monte Albo.

Acallorneuma poggii sp. n. Figg. 2i, 3g, 7d

Località tipica: Dorgali (Sardegna)

Materiale tipico. Holotypus e 2 paratypi femmine così etichettati "Sardegna, Dorgali, V. 1910, A. Dodero" (coll. A. Dodero MGCD); idem 1 paratypus femmina.

Diagnosi. Lunghezza 3.81 mm. A motivo della punteggiatura delle elitre (Figg. 2g, 2i) e della conformazione dello spiculum ventrale (Figg. 7b, 7d), la nuova specie si avvicina ad *A. sardiniensis* n. sp.; se ne differenzia per le dimensioni leggermente inferiori (3.81 mm contro 4.00 mm), per il pronoto più lungo e meno largo, superficialmente punteggiato, per lo scutello incospicuo e per avere solo due anziché quattro rilievi dentiformi sul lato inferiore dei femori (Figg. 3g, 3h).

Descrizione dell'holotypus femmina. Corpo allungato, rosso bruno, brillante, punteggiato, interstrie con setole semirilevate. Occhi ovali, con 22 ommatidi. Rostro leggermente allargato alla base (dopo la strozzatura basale), poi a lati paralleli, ricurvo regolarmente, con carena mediana liscia e brillante, distalmente liscio con punteggiatura spaziata discretamente forte. Antenne rossicce con scapo regolarmente ingrossato; funicolo a primi due articoli allungati (ma il 1° leggermente più robusto del 2°), restanti subquadrati, via via ingrossati, 7° sferico; clava ellittica. Scrobe come in *A. sardiniensis*.

Pronoto a base rettilinea, più lungo che largo, massima ampiezza ai 2/3 dalla base, fittamente punteggiato con punti non variolosi, sul disco di diametro inferiore agli spazi che li intervallano; carena mediana assente. Scutello incospicuo.

Elitre a base rettilinea, con la massima ampiezza nel 1/3. Sutura saldata, ben visibile. Strie elitrali meno larghe delle interstrie, con punti profondi, sferici o lievemente ellittici, da cui spuntano brevi setole, in numero di 12-13, ben visibili ai lati del corpo e nella declività posteriore (Fig. 2i).

Femori provvisti, inferiormente, di un solco rudimentale, con due rilievi dentiformi (Fig. 3g).

Solco prosternale più incavato nella parte terminale rispetto alla mediana, imbutiforme tra capo e procoxe. Sutura tra urosterno 1° e 2° obliterata nella parte mediana, infossata ai lati, quest'ultimi con punti rotondi regolarmente disposti. Spiculm ventrale e spermateca: Fig. 7d.

Descrizione del paratypus femmina. Il paratypus femmina (privo del capo) differisce dall'holotypus per le dimensioni leggermente inferiori e per la punteggiatura del pronoto più leggera.

Dati morfometrici. Femmina: Lusc = 0.37 mm; Lufu = 0.41 mm; Lucl = 0.19 mm; Luro = 0.72 mm; Lupr = 1.03 mm; Luel = 2.06 mm; Lapr = 0.97 mm; Lael = 1.31 mm.

Note comparative. Vedi diagnosi nonchè quanto riportato nella diagnosi di *A. sardiniensis* n. sp.

Derivatio nominis. Questa specie è dedicata al dottor Roberto Poggi, Direttore del Museo Civico di Storia Naturale di Genova, collega ed amico caro in tante ricerche entomologiche nel Mediterraneo occidentale.

Ecologia e biologia. Valgono anche per questa specie le osservazioni riportate per gli altri *Acallorneuma* sardi.

Distribuzione geografica. Si tratta quasi certamente, di un endemismo della regione costiera del Nuorese.

Acallorneuma sardiniensis sp. n. Figg. 2g, 3h, 5b,7b

Località tipica: Lula (Sardegna)

Materiale tipico. Holotypus maschio e 4 paratipi (2 maschi, 2 femmine) etichettati "Lula Sard., VI.1911, A. Dodero" (coll. A. Dodero MGCD).

Materiale esaminato. Galtellì (NU), 6.II.2001, 1 femmina, leg. Fancello.

Diagnosi. Lunghezza 4.00-4.13 mm. A motivo dei femori con quattro dentelli e dell'edeago ad apice appuntito, la nuova specie si avvicina massimamente ad *A. mainardii.* Se ne differenzia per lo scutello evidente, per le interstrie quasi due volte più larghe delle strie (Figg. 2g, h), per la clava antennale più allungata e per l'edeago meno ricurvo (Figg. 5a, b).

Descrizione dell'holotypus maschio. Corpo ovale-allungato, rosso-bruno, debolmente brillante, antenne e tarsi rosso chiari con elitre oblungo-ovali con brevi setole sulle interstrie; capo globoso, infossato nel protorace, occhi appiattiti, cordiformi, con 24 ommatidi. Rostro a lati subparalleli, ricurvo, con distinta strozzatura basale, fittamente ma superficialmente punteggiato tra capo ed inserzione delle antenne poi con punteggiatura molto spaziata distalmente con apice brillante. Scrobe parallele lucide, poco profonde, appena allargate all'altezza degli occhi. Scapo poco ingrossato apicalmente; funicolo con i primi due articoli allungati ma 1° molto robusto e nettamente più largo del 2°, quest'ultimo circa 1/3 più lungo del 1°, 3°

subquadrato, 4° appena più lungo che largo, 5° subquadrato, 6°-7° subsferici; clava molto robusta con 1° articolo lungo circa i 3/5 dell'intera clava.

Protorace non carenato leggermente arcuato alla base, trasverso, massima ampiezza ai 2/3 dalla base, non variolosamente punteggiato, con punti più piccoli disordinatamente disposti sul disco, allineati ai margini. Scutello semicircolare.

Elitre a base rettilinea, circa del doppio più lunghe che larghe, con la massima ampiezza subito dietro gli omeri; sutura elitrale obliterata. Strie piane, liscie, larghe appena la metà delle interstrie, con punti rotondi, superficiali, muniti di una breve setola, ben separati tra di loro sino ai 2/3 dell'elitra (cioè sino all'11° o 12° punto) poi indistinti tanto che la stria appare come un solco libero (Fig. 2g).

Femori con 4 minuscoli rilievi dentiformi sul margine interno (Fig. 3h); tarsi a 1° articolo conico-allungato, 2° trasverso, 3° bilobo.

Prosterno con canale rostrale a lati paralleli, leggermente ristretto solo all'altezza delle procoxe poi nuovamente ampliato tra queste e le mesocoxe. Procoxe (più rilevate) e mesocoxe (meno evidenti) distanziate da uno spazio equivalente. Metasterno collocato su un piano rilevato rispetto agli urosterni. Urosterniti 1° e 2° molto larghi (1° più largo del 2°), leggermente infossati medialmente, con punti profondi, disordinatamente disposti, di dimensioni difformi, privi di setole; sutura tra 1° e 2° urosternite obliterata; urosterniti 3° e 4° stretti, subeguali, irregolarmente punteggiati, con spazi zigrinati; 5° urosternite con forte punteggiatura rotonda. Edeago, spicula e spermateca (Figg. 5b, 7b).

Descrizione dei paratipi. I due paratipi maschi divergono lievemente dal tipo per la punteggiatura del pronoto. Uno di essi, presenta altresì una lieve carena mediana sul disco del pronoto nonchè la punteggiatura delle interstrie semplice (anzichè doppia). La femmina differisce dai maschi per gli urosterniti subpiani e per le setole delle interstrie appena più brevi e sottili.

Dati morfometrici. Maschio: Lusc = 0.41 mm; Lufu = 0.44 mm; Lucl = 0.22 mm ± 0.02; Luro = 0.72 mm; Lupr = 1.09 mm ± 0.04; Luel = 2.19 mm ± 0.03; Lapr = 1.12 mm; Lael = 1.47 mm ± 0.01. Femmina: Lusc = 0.47 mm ± 0.07; Lufu = 0.5 mm ± 0.06; Lucl = 0.25 mm ± 0.02; Luro = 0.81 mm ± 0.06; Lupr = 1.28 mm ± 0.18; Luel = 2.34 mm ± 0.28; Lapr = 1.22 mm ± 0.13; Lael = 1.56 mm ± 0.13.

Derivatio nominis. Dalla Sardegna, patria tipica.

Note comparative. Oltre che con *A. mainardii*, la nuova specie si avvicina ad *A. poggii* n. sp. da cui si differenzia per le caratteristiche riportate nelle rispettive diagnosi.

Ecologia e biologia. Ecologia e biologia sconosciute.

Distribuzione geografica. Endemismo sardo, presumibilmente esclusivo del Monte Albo. Ignoriamo se sia sintopico con *A. montisalbi* e con *A.* sp. prope *sardiniensis* anch'essi raccolti nell'area del Monte Albo.

Acallorneuma gasparoi sp. n. Figg. 2l, 3l, 4d, 7c

Località tipica: Dorgali (Sardegna)

Materiale tipico. Holotypus maschio (MSNV) e paratipi (6 exx.) così etichettati "Sardegna, Dorgali, 250 m, 18.X.1989, V. 1910, leg. F. Gasparo".

Diagnosi. Lunghezza 3.78-4.59 mm. A motivo della punteggiatura delle elitre (Figg. 2i-l), dei femori inferiormente provvisti di due dentelli (Fig. 3l) e per la conformazione dello spiculum ventrale (Figg. 7b-c), la nuova specie si avvicina ad *A. poggii* n. sp.; se ne differenzia per le dimensioni maggiori (4.59 mm contro 3.81 mm), per il corpo non brillante, per lo scutello subtriangolare, per le zampe leggermente più slanciate (Figg. 3g, 3l), nonché per gli occhi depigmentati.

Descrizione dell'holotypus maschio. Corpo allungato, rossiccio, elitre opache, punteggiato, interstrie con setole uniformemente coricate. Occhi ovali, depigmentati, con 18 ommatidi. Rostro leggermente allargato alla base (dopo la strozzatura basale), poi a lati paralleli, ricurvo regolarmente, con carena mediana liscia ed opaca, distalmente liscio con punteggiatura fine e spaziata. Scrobe parallele, lisce, evidenti, ampiamente allargate all'altezza degli occhi. Pronoto leggermente arcuato alla base, più lungo che largo, massima ampiezza ai 2/3 dalla base, fittamente punteggiato con punti più radi solo sul disco, di diametro uguale o di norma superiore agli spazi che li intervallano; carena mediana assente. Scutello emisferico, debolmente infossato.

Elitre a base leggermente arcuata, allungato-ellittiche con la massima ampiezza nel 1/3. Sutura saldata, ben visibile. Strie elitrali meno larghe delle interstrie, con punti profondi, sferici o lievemente ellittici da cui spuntano brevi setole, in numero di 19-20 sino alla declività posteriore (Fig. 2l).

Femori con due piccoli rilievi dentiformi sul margine esterno provvisti, inferiormente, di un solco rudimentale (Fig. 3l).

Solco prosternale uniforme, leggermente ristretto verso le procoxe, a margini rilevati. Sutura tra urosterno 1° e 2° obliterata nella parte mediana, infossata ai lati; urosterniti con robusta punteggiatura rotonda. Spiculum ventrale e spermateca: Figg. 4d, 7c.

Nota. Non viene riportata la descrizione delle antenne in quanto tutti gli esemplari raccolti morti ne sono risultati privi.

Descrizione dei paratipi. I frammenti di elitre non sono descrivibili.

Dati morfometrici. Maschio: Luro = 0.72 mm; Lupr = 1.19 mm; Luel = 2.03 mm; Lapr = 1.06 mm; Lael = 1.44 mm. Femmina: Luro = 0.81 mm; Lupr = 1.28 mm; Luel = 2.5 mm; Lapr = 1.19 mm; Lael = 1.62 mm.

Derivatio nominis. Questa specie è dedicata al dr. Fulvio Gasparo (Trieste) che con squisita cortesia ha inviato in studio ad uno di noi (Osella) tutti i materiali di grotta relativi ai Coleotteri Curculionidi raccolti in anni di indagini in varie aree italiane e centro europee.

Note. Vedi diagnosi nonchè quanto riportato nella diagnosi di *A. poggii* n. sp.

Ecologia e biologia. Tutto il materiale è stato raccolto nella Grotta di Cumbida Prantas, località Codula Fuili nel comune di Dorgali. Si tratta di una grotta suborizzontale, riccamente concrezionata, che si apre sul fianco di un vallone. Gli esemplari morti sono stati rinvenuti su colate calcitiche bagnate, nella parte più profonda della grotta, a circa un centinaio di metri dall'ingresso (Gasparo in litteris).

Distribuzione geografica. Anche in questo caso si tratta quasi certamente, di un endemismo della regione costiera del Nuorese.

Acallorneuma peyerimhoffi F. Solari, 1938 Figg. 2e, 3i, 4d, 7f

Località tipica: Guerrouch (Piccola Kabylia, Algeria)

Solari, 1938: 29. Osella & Zuppa, 1993: 420-421.

Materiale esaminato. Holotypus femmina etichettato "Algeria, Guerrouch, L. de Borde" (MSNM).

Ridescrizione. Lunghezza 3.75 mm. Per la punteggiatura delle elitre, per i femori muniti di due piccoli rilievi dentiformi e per lo spiculum ventrale si differenzia nettamente da tutte le altre specie. Altre caratteristiche differenziali sono: base del pronoto e delle elitre pressochè rettilinea con strie elitrali a punteggiatura variolosa con punti ovalo-oblunghi oppure sferici, talvolta fusi insieme a due a due. Strie di larghezza circa doppia delle interstrie. Interstrie impari più rilevate delle pari, ognuna con circa 20 punti da cui sporgono piccole setole (Fig. 2e). Tibie debolmente setolose, non dentellate sul margine esterno, femori brevemente e superficialmente incavati sul margine inferiore, profemori con due piccoli rilievi dentiformi, meso e metafemori inermi (Fig. 3i). Sterniti fortemente punteggiato-variolosi. Canale rostrale leggermente svasato anteriormente. Mesocoxe distanziate quanto le procoxe. Mesosterno con setole lunghe. Metacoxe separate da uno spazio pari a tre volte maggiore di quello che separa le coxe mediane. Urosterniti fortemente punteggiati; 1° sternite circa due volte più largo del secondo con spazi tra i punti zigrinati e più ampi del diametro dei punti stessi.

La specie è stata descritta su due femmine. Non abbiamo controllato il paratipo (Solari, 1938), conservato nella collezione Peyerimhoff, al Museo di Parigi. Questo esemplare, secondo F. Solari (1938), presenterebbe le elitre meno scolpite del tipo. In mancanza di esame diretto non ci è possibile respingere o accettare l'ipotesi di Solari circa la possibile origine teratologica delle differenze riscontrate. Spiculum ventrale: Fig. 7f.

Dati morfometrici. Femmina: Lusc = 0.37 mm; Lufu = 0.41 mm; Lucl = 0.22 mm; Luro = 0.69 mm; Lupr = 1.12 mm; Luel = 1.94 mm; Lapr = 1.12 mm; Lael = 1.41 mm.

Dati di letteratura. Algiria, Guerrouch, 2 femmine, leg. P. de Peyerimhoff de Fontenelle.

Ecologia e biologia. Anche per questa specie non disponiamo di alcun dato. Non ci è nota nemmeno la data di raccolta degli esemplari. Ci sembra, comunque, ragionevole ritenere che l'ambiente di raccolta sia il bosco misto che caratterizza le aree sommitali della Piccola Kabylia.

Distribuzione geografica. Endemismo algerino.

FENOLOGIA IMMAGINALE

Come accennato altrove, nulla ci è noto della biologia delle varie specie di *Acallorneuma*, neppure le piante ospiti di larve ed adulti. E' infatti incerto se le larve siano rizofaghe o si nutrano di legno morto oppure ancora se il victus sia diverso tra larve e adulti. Ignoriamo, inoltre, la durata della vita immaginale. *A. reitteri* in Abruzzo è presente tutto l'anno ma è più comune nei mesi di aprile-maggio e settembre-ottobre. Gli sfarfallamenti, in base al colore degli individui immaturi raccolti, sembrano avvenire in agosto.

Nella tabella I sono riassunti i dati fenologici disponibili per tutte le specie (ad eccezione di *A. peyerimhoffi* di cui non è nota la data di cattura).

TAB. I - Fenologia immaginale delle specie di *Acallorneuma* Mainardi.

	G	F	M	A	M	G	L	A	S	O	N	D
reitteri	•	•	•	•	•	•	•	•	•	•	•	•
ingoi				•	•					•	•	•
doderoi					•							
sabellai			•									
mainardii					•							
montisalbi			•		•							
poggii					•							
sardoum						•						
gasparoi					•							

DISTRIBUZIONE GEOGRAFICA

Acallorneuma presenta distribuzione tirrenica (Osella, 1979; Osella & Zuppa, 1993) (Fig. 8, 9). E' tuttavia possibile che l'attuale quadro distribuzionale, per la peculiare ecologia del genere, sia ancora lacunoso. Non si può infatti dimenticare che ben tre delle sei specie inedite qui descritte sono diagnosticate su materiali storici; che cinque *Acallorneuma* ci sono noti esclusivamente sui tipi; che ben cinque sono conosciuti di una sola località e che, infine, di altri cinque di essi conosciamo solo 1-3 esemplari. E' pertanto ovvio che, per un quadro dettagliato, dovranno essere accuratamente indagate sia le aree tirreniche (dove il taxon non è ancora noto) (Corsica, Liguria, Provenza, Herault, Pirenei orientali, Catalogna, isole Baleari e Spagna mediterranea), sia soprattutto quei territori di cui disponiamo solo di dati puntiformi (Sicilia, Sardegna, Maghreb, Appennino meridionale e settentrionale). Solo per due taxa (*A. reitteri* ed *A. ingoi*) i dati attuali sono sufficientemente significativi per un primo quadro di insieme. E' prevedibile, infine che nuove entità possano essere individuate in futuro con l'estendersi e l'approfondirsi delle indagini data la tendenza all'endemismo di quasi tutte le specie conosciute ed, in particolare, delle entità sarde e sicule.

E' da sottolineare, infine, che solo per *A. reitteri* ed *A. ingoi* si riscontra una marginale sovrapposizione degli areali, fatto quest'ultimo che sottolinea non solo le diverse esigenze ecologiche delle due specie ma anche zoogeografiche e storiche (vedi ecologia).

ECOLOGIA

Anche le informazioni sull'ecologia di *Acallorneuma* sono pressochè nulle. I soli dati disponibili sono in Mainardi (1906) e Osella & Zuppa (1993) e riguardano esclusivamente *A. reitteri*. La presente ricerca, basata su 42 campionamenti in 15 località negli anni 1998-2000, ci permette le seguenti preliminari considerazioni:

1) *A. reitteri* nell'Appennino centrale, si rinviene esclusivamente al vaglio della lettiera superficiale dei boschi misti a latifoglie;

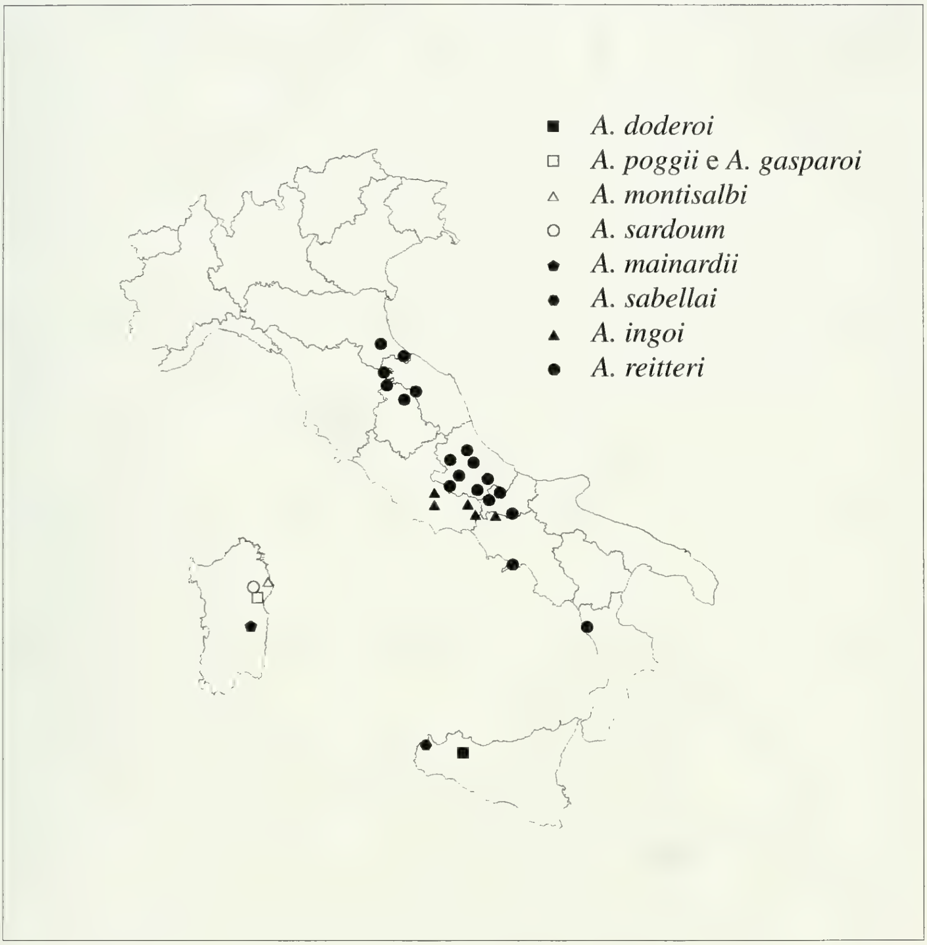

FIG. 8
Distribuzione italiana delle specie di *Acallorneuma* Mainardi.

2) le quote di presenza, sono comprese tra i 465 m (Tocco da Casauria) ed i 1200 m (Barrea strada per Lago Vivo) con netta prevalenza per quelle comprese tra i 700 m ed i 1000 m;

3) particolarmente prediletti sono gli ostrieti e i querceto-ostrieti; solo raramente è stata raccolta nelle quercete pure o ai margini inferiori della faggeta;

4) a parità di quota e di vegetazione del sottobosco sembrano preferiti i versanti a N e N-O meno frequentemente quelli a N-E. *A. reitteri* sembra evitare i versanti a S ed a S-E, i boschi ceduati, i boschi ripariali e le macchie arborate isolate tra i coltivi;

5) privilegiate sono risultate le aree ecotonali con vegetazione nemorale quale *Daphne laureola* L., *Cyclamen purpurascens* Mill., *Primula vulgaris* Huds., *Scilla*

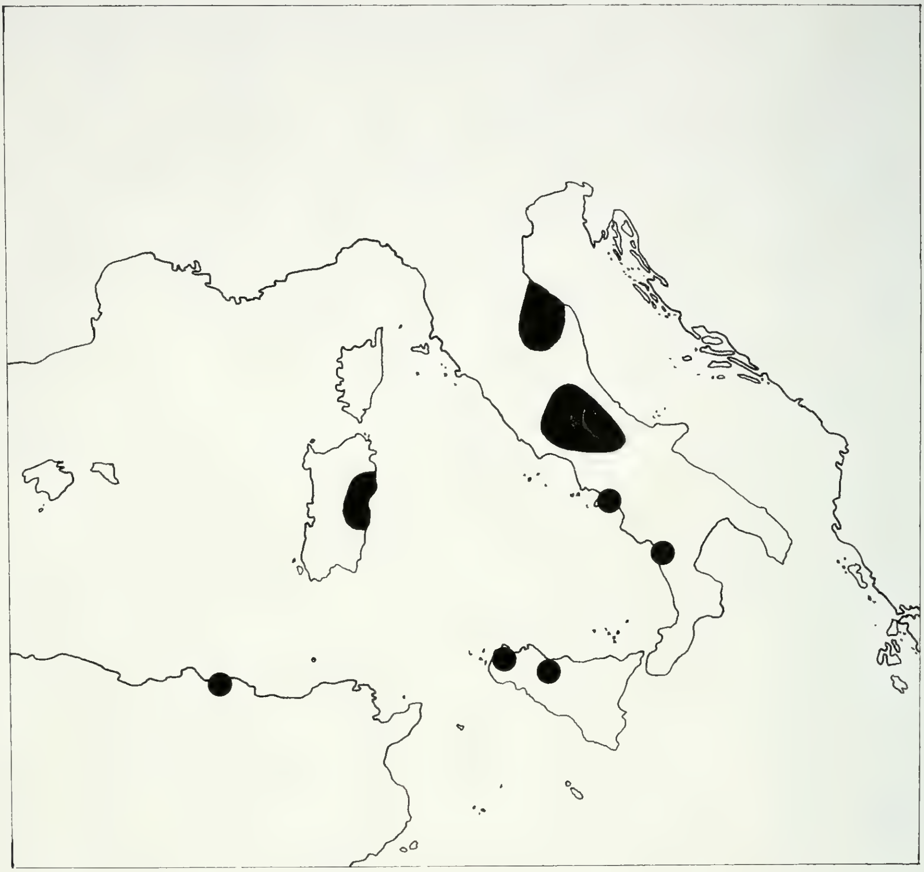

FIG. 9
Distribuzione generale di *Acallorneuma* Mainardi.

bifolia L., *Eranthis hiemalis* (L.), *Anemone ranunculoides* L., *Anemone apennina* L., *Hedera helix* L., talvolta con muschi. Sembra pure rifuggire le aree interne dei boschi eccessivamente ombrose con suolo privo di vegetazione erbacea, i suoli non drenati, i boschi radi con lettiera che, d'estate, è sottoposta all'irraggiamento solare e con vegetazione sul soprassuolo a graminacee ed a cespugli pionieri;

6) ad *A. reitteri*, in tutto l'Appennino interno, è associata una curculionidofauna relativamente ripetitiva. Eccezion fatta per le entità estivanti o ibernanti allo stadio immaginale, le occasionali e le frondicole (soprattutto in primavera) essa è costituita da entità xilofaghe (*Echinomorphus, Kyklioacalles, Echinodera, Acallocrates, Aparopion, Phaenoterion*) ed, in minor numero, da detriticole-humicole (a biologia non conosciuta ma a larve verosimilmente rizofaghe) (*Pseudomeira, Simo, Brachysomus, Orthochaetes setiger* ecc.). Tutti questi taxa, humicoli e forestali, presentano in genere un'ecologia più ampia di quella di *Acallorneuma* essendo pre-

senti in ambienti nemorali i più variati per struttura, esposizione e livello di conservazione ambientale. Eccezionale invece è la presenza di *Raymondionymus marqueti apenninus* e di *Otiorhynchus* subgen. *Lixorhynchus*, la cui presenza sembra limitata, sempre all'Appennino centrale, alle aree più fresche dei versanti a Nord;

7) tra le specie accompagnatrici, due in particolare sembrano presentare un'ecologia largamente comparabile a quella di *Acallorneuma*: *Aparopion chevrolati* e *Kyklioacalles punctaticollis* entrambi presenti spesso negli stessi ambienti di vita di *A. reitteri.*

Qualche osservazione è disponibile anche per *A. ingoi*. Questo taxon, pur prediligendo gli stessi ambienti di *A. reitteri*, sembra differire per alcune caratteristiche quali: a) le quote di raccolta di norma inferiori (dai 200 agli 800 m); b) l'esposizione essendo essi apparentemente meno legati al versante N-O; c) il substrato che comprende anche i suoli vulcanici. E' da notare che questa specie è l'unica che, insieme ad *A. gasparoi* (Sardegna), sia stata raccolta in grotta.

Questo dato, unitamente a quello di *A. sabellai* (Sicilia) e di un esemplare femmina *Acallorneuma* sp. (indeterminabile) (Mel) rinvenuti sotto pietre profondamente infossate, sembra indicare un peculiare adattamento alle condizioni tipiche di habitat forestali mediterranei e submediterranei. Infine la coleotterofauna che l'accompagna enumera un più rilevante numero di entità specializzate alla lettiera e al suolo profondo. Tra i Curculionidae ricordiamo *Alaocyba, Raymondionymus, Torneuma* e *Otiorhynchus* subgen. *Lixorhynchus*, Staphylinidae Leptotyphlinae, Bathyscinae e Pselaphidae ecc.

In conclusione *A. ingoi* sembra più esigente in fatto di termofilia di *A. reitteri* esigenza che sarebbe documentata anche dalla costante presenza nelle nostre raccolte del più termofilo *A. suturidens* Reitter, 1891, rispetto ad *Aparopion chevrolati* (J. Du Val, 1868) (cfr. Zuppa & Osella 1999). *A. ingoi* e *A. reitteri* sono stati, inoltre, come già detto altrove, ritrovati in simpatria solo ad Alvito località Valle Rio (Frosinone) a 700 m di quota.

CHIAVE DICOTOMICA DEL GENERE *ACALLORNEUMA* MAINARDI, 1906

1 Femori anteriori con dente mediano evidente. Edeago ad apice uniformemente arrotondato (Figg. 3a, 3f) 2

- Femori anteriori inermi o minutamente dentellati. Edeago, nelle specie conosciute, ad apice più o meno triangolare (Figg. 3b, 3c, 3d, 3e, 3g, 3h, 3i, 3l) 3

2 Pronoto variolosamente e disordinatamente punteggiato. Strie elitrali a punteggiatura robusta ma non variolosa, meno larghe delle interstrie, quest'ultime piane con setole brevi reclinate (Fig. 2f). Apice estremo dell'edeago largamente subacuto (Fig. 4c). Edeago, spicula e spermateca Fig. 7e. Lunghezza mm 3.72-3.97. Monte Albo (Sardegna) . . . . *montisalbi* sp. n.

- Pronoto meno variolosamente e meno disordinatamente punteggiato. Strie elitrali variolosamente punteggiate più larghe delle interstrie, quest'ultime convesse con setole semirilevate (Fig. 2a). Apice estremo dell'edeago uniformemente arrotondato. Edeago, spicula e spermateca Figg. 4a, 6 a,b,c. Lunghezza mm 2.06-3.59. Italia appenninica (dalla Toscana alla Calabria) . . . . *reitteri* Mainardi, 1906

3 Spiculum ventrale con apodemi contigui alla base. Femori con due piccoli rilievi dentiformi (Fig. 3i). Strie elitrali due volte più larghe delle interstrie, con punti ovalo-oblunghi (Fig. 2e). Spiculum ventrale Fig. 7f. Lunghezza mm 3.75. Guerrouch (Algeria) . . *peyerimhoffi* Solari, 1938

- Spiculum ventrale con apodemi saldati alla base 4

4 Pronoto con punteggiatura profonda e carena mediana obsoleta. Strie elitrali più larghe delle interstrie 5

- Pronoto con punteggiatura superficiale. Strie elitrali meno larghe delle interstrie 6

5 Pronoto con punti piccoli; scutello semicircolare. Punti delle strie elitrali provvisti di una minuscola setola (Fig. 2b). Femori con 5 piccoli rilievi dentiformi (Fig. 3b). Edeago, spicula e spermateca Figg. 4b, 6d. Lunghezza mm 3.09-4.03. Forca d'Acero (Lazio) . . . . *ingoi* sp. n.

- Pronoto con punti più grandi che in *ingoi*; scutello non visibile. Punti delle strie elitrali sprovvisti di setola (Fig. 2h). Femori inermi (Fig. 3e). Edeago, spicula e spermateca Figg. 5a, 7a. Lunghezza mm 4.06. Seui (Sardegna) . . . . *mainardii* A. & F. Solari, 1908

6 Pronoto con carena mediana assente. Sutura tra 1° e 2° urosternite non evidente. Specie sarde 7

- Pronoto con carena mediana evidente. Sutura tra 1° e 2° urosternite evidente. Specie sicule 9

7 Punteggiatura delle strie elitrali profonda; sutura elitrale saldata ben visibile. Femori con 2 piccoli rilievi dentiformi (Figg. 3g, 3l) 8

- Punteggiatura delle strie elitrali superficiale; sutura elitrale obliterata. Femori con 4 piccoli rilievi dentiformi (Fig. 2h). Edeago, spicula, spermateca Figg. 5b, 7b. Lunghezza mm 4.00-4.13. Lula (Sardegna) . . . . *sardiniensis* sp. n.

8 Occhi pigmentati. Elitre debolmente brillanti. Scutello incospicuo. Spiculum ventrale e spermateca Fig. 7d. Lunghezza mm 3.81. Dorgali (Sardegna) . . . . *poggii* sp. n.

- Occhi depigmentati. Elitre opache. Scutello visibile. Edeago, spicula e spermateca Figg. 4d, 7c. Lunghezza mm 3.78-4.59. Dorgali (Sardegna) . . . . *gasparoi* sp. n.

9 Pronoto alquanto arrotondato ai lati. Punti delle strie provvisti di una piccola setola; interstrie con punti anch'essi provvisti di setola reclinata intervallati da altri (2-3) privi di setola (Fig. 2c). Tibie fortemente crenellate sul margine esterno (Fig.3c). Edeago, spicula e spermateca Figg. 5c, 6e. Lunghezza mm 3.31-5.28. Ficuzza (Sicilia) . . . . *doderoi* Solari & Solari, 1908

- Pronoto cordiforme arcuato ai lati. Punti delle strie sprovvisti di una piccola setola; interstrie con punti tutti con setole evidenti (Fig. 2d).

Tibie lievemente crenellate sul margine esterno (Fig. 3d). Spiculum ventrale e spermateca Fig. 6f. Lunghezza mm 4.13. Erice (Sicilia orientale) . . . . *sabellai* sp. n.

ANALISI FILOGENETICA DEL GENERE *ACALLORNEUMA* MAINARDI, 1906

La sistematica e la tassonomia dei Criptorinchini è attualmente in fase di profonda revisione (Stüben, 1998; Stüben & Wolf, 1998; Stüben & Behne, 1998; Stüben, 1999a, 1999b), con la creazione di nuovi generi e sottogeneri. Qui noi tentiamo uno studio comparativo prendendo in considerazione caratteri morfologici considerati di maggiore significato filogenetico per il genere quali: corpo allungato-cilindrico, elitre più o meno fortemente striato-punteggiate ed apice del lobo mediano dell'edeago. Tale analisi ha evidenziato una elevata affinità tra il più primitivo genere *Kyklioacalles* ed il genere più derivato *Acallorneuma*.

L'analisi cladistica di quest'ultimo genere è stata effettuata utilizzando 15 caratteri (Tab. II) relativi alla morfologia esterna, alla vestitura del corpo ed alle armature genitali maschili e femminili.

Lo stato apomorfo, per ogni carattere, è stato stabilito dal confronto con il genere *Kyklioacalles* mediante l'outgroup comparison.

La condizione monofiletica del genere *Acallorneuma* è definita dalle seguenti sinapomorfie: occhi ridotti (1), elitre più larghe del pronoto (3), assenza di squame sul corpo (4).

La matrice degli stati di carattere (Tab. III) è stata elaborata con il PAUP, mediante il metodo di parsimonia di Wagner, versione 4.0b8, utilizzando l'opzione "branch-and-bound" per individuare tutti gli alberi più parsimoniosi (Swofford, 1993).

Gli alberi ottenuti sono stati considerati come input files per il calcolo dell'albero di Consenso Majority Rule riportato in Fig. 10 (CI = 0.7083; HI = 0.2917; RI = 0.6111).

In oltre la metà degli alberi ottenuti *A. sardiniensis* è posizionato come "sister species" delle rimanenti specie del genere in quanto, benchè condivida con le altre alcuni caratteri (occhi ridotti, elitre più larghe del pronoto, assenza di squame sul corpo, edeago con manubrio allungato, apice del lobo mediano dell'edeago privo di setole, struttura del sacco interno semplice, lamine dello spiculum ventrale aperte) in stato apomorfo, se ne differenzia per i femori inermi e per l'assenza del solco femorale atto a ricevere le tibie a riposo. La presenza di questi due caratteri, in stato plesiomorfo, conferisce alla stessa una condizione vicina a quella di un ipotetico progenitore del genere.

I rapporti di parentela raffigurati nel cladogramma lascerebbero ipotizzare che le specie sarde si sarebbero originate a seguito di eventi di vicarianza avvenuti in tempi diversi. La posizione di *A. sardiniensis* suggerirebbe una più antica origine di questa rispetto alle altre specie sarde (*A. montisalbi, A. mainardii, A. poggii, A. gasparoi*).

Di difficile interpretazione risultano pure alcuni pattern di parentela tra le specie siciliane (*A. doderoi*, *A. sabellai*), appenniniche (*A. reitteri*, *A. ingoi*) e la

TAB. II - Elenco dei caratteri utilizzati nell'analisi cladistica.

1 - Occhi grandi (0); occhi ridotti (1)
2 - Punteggiatura del pronoto profonda (0); punteggiatura del pronoto superficiale (1)
3 - Elitre larghe quanto il pronoto (0); elitre più larghe del pronoto (1)
4 - Presenza di squame sul corpo (0); assenza di squame sul corpo (1)
5 - Punti delle elitre prive di setole (0); punti delle elitre provvisti di setole (1)
6 - 1° e 2° urosternite con sutura evidente (0); 1° e 2° urosternite saldati alla sutura (1)
7 - Femori inermi (0); femori dentati o crenellati (1)
8 - Femori non solcati (0); femori solcati (1)
9 - Edeago con manubrio corto (0); edeago con manubrio allungato (1)
10 - Apice del lobo mediano provvisto di setole (0); apice del lobo mediano privo di setole (1)
11 - Apice del lobo mediano arrotondato (0); apice del lobo mediano a punta (1)
12 - Struttura del sacco interno complessa (0); struttura del sacco interno semplice (1)
13 - Lamine dello spiculum ventrale completamente chiuse (0); lamine dello spiculum ventrale completamente aperte (1)
14 - Lamine dello spiculum ventrale corte (0); lamine dello spiculum ventrale allungate (1)
15 - Apodemi dello spiculum ventrale saldati (0); apodemi dello spiculum ventrale contigui (1)

TAB. III - Matrice dei caratteri utilizzati nell'analisi cladistica

Caratteri	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Kyklioacalles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A. reitteri	1	0	1	1	1	0	1	1	1	1	0	1	1	0	1
A. ingoi	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0
A. doderoi	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0
A. sabellai	1	1	1	1	0	1	1	1	?	?	?	?	1	1	0
A. mainardii	1	0	1	1	0	0	1	1	1	1	1	1	1	1	0
A. montisalbi	1	0	1	1	1	1	1	1	1	1	0	1	?	?	?
A. poggii	1	1	1	1	1	0	1	1	?	?	?	?	1	1	0
A. sardiniensis	1	1	1	1	0	0	0	0	1	1	1	1	1	1	0
A. gasparoi	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
A. peyerimhoffi	1	1	1	1	0	0	1	1	?	?	?	?	1	1	1

Character change lists:

Character	**CI**	**Steps**	**Changes**		
1	1.000	1	Node 17	1→ 0	Kyklioac
2	0.333	1	Node 17	1→ 0	Kyklioac
		1	Node 14	1→ 0	node 13
		1	Node 16	1→ 0	A. mainard
3	1.000	1	Node 17	1→ 0	Kyklioac
4	1.000	1	Node 17	1→ 0	Kyklioac
5	0.500	1	Node 16	0→ 1	node 14
		1	Node 15	0→ 1	A. gaspar
6	0.500	1	Node 12	0→ 1	A. montis
		1	Node 16	0→ 1	node 15
7	1.000	1	Node 17	0→ 1	node 16
8	1.000	1	Node 17	0→ 1	node 16
9	1.000	1	Node 17	1→ 0	Kyklioac
10	1.000	1	Node 17	1→ 0	Kyklioac
11	0.500	1	Node 17	1→ 0	Kyklioac
		1	Node 13	1→ 0	node 12
12	1.000	1	Node 17	1→ 0	Kyklioac
13	1.000	1	Node 17	1→ 0	Kyklioac
14	0.500	1	Node 17	1→ 0	Kyklioac
		1	Node 13	1→ 0	node 12
15	0.500	1	Node 13	0→ 1	node 12
		1	Node 16	0→ 1	A. peyer

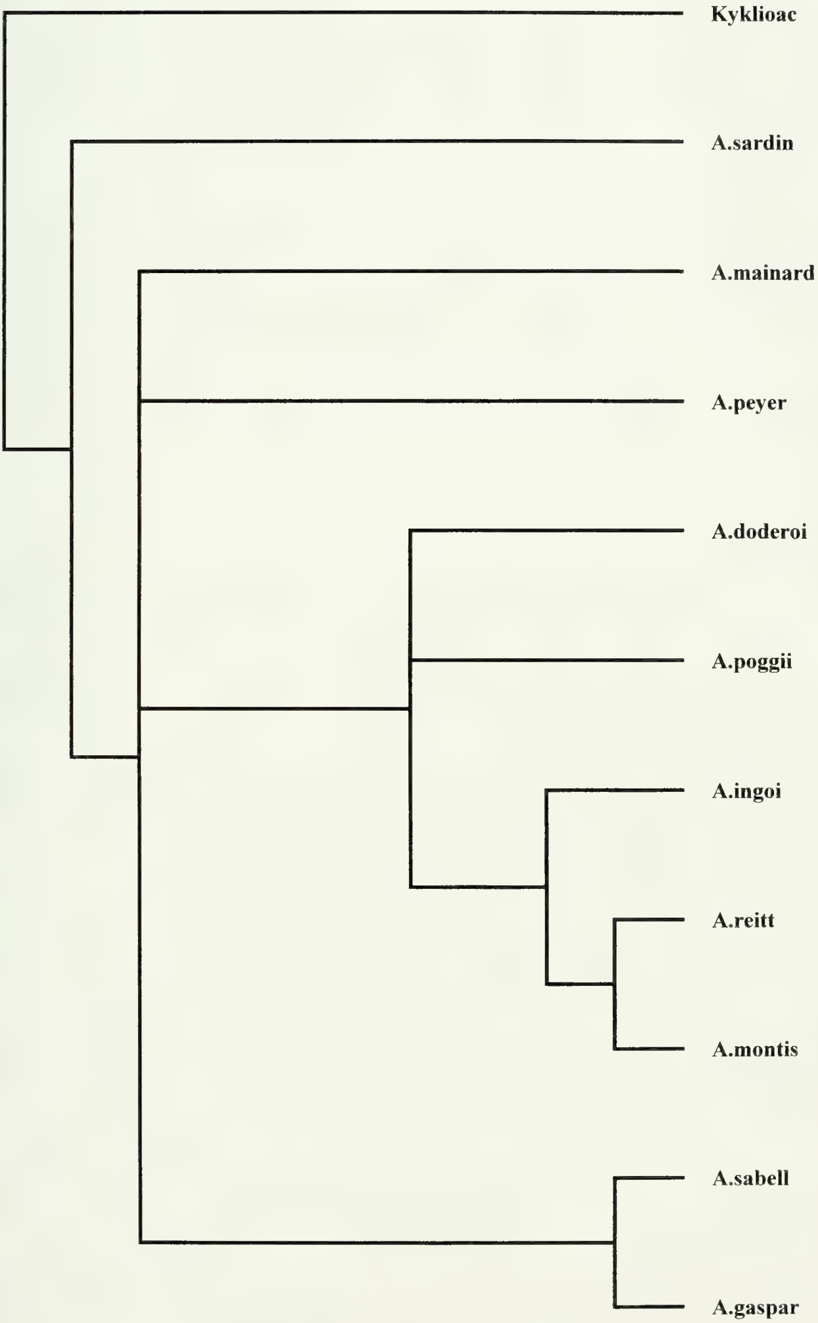

FIG. 10
Albero di Consenso delle specie di *Acallorneuma* Mainardi.

specie nord africana (*A. peyerimhoffi*). L'ipotesi di ricostruzione filogenetica viene resa incerta anche dal fatto che alcuni importanti caratteri informativi, quali quelli riferiti alle armature genitali maschili di *A. sabellai*, *A. poggii*, *A. peyerimhoffi* o femminili di *A. montisalbi*, non sono noti.

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BIBLIOGRAFIA

ABBAZZI, P. & OSELLA, G. 1992. Elenco sistematico-faunistico degli Anthribidae, Rhinomaceridae, Attelabidae, Apionidae, Brentidae, Curculionidae italiani (Insecta, Coleoptera, Curculionoidea). I Parte. *Redia* 75 (2): 267-414.

ABBAZZI, P. *et al.* 1994. Coleoptera Polyphaga XVI (Curculionoidea). *In*: MINELLI, A., RUFFO, S. & LA POSTA, S. (ed.). Checklist delle specie della fauna italiana, 61. *Edizioni Calderini, Bologna*, 68 pp.

ALONSO-ZARAZAGA, M. A. & LYAL, C. H. C. 1999. A World Catalogue of Families and Genera of Curculionoidea (Insecta: Coleoptera) (Excepting Scolytidae and Platypodidae). *Entomopraxis S. C. P. Edition*, 315 pp.

CAMARDA, I. 1993. Flora e paesaggio vegetale nelle Montagne Sarde. *In*: Montagne di Sardegna. *Editore Carlo Delfino*: 81-102.

GINESU, S. 1993. Aspetti geomorfologici delle Montagne Sarde. *In*: Montagne di Sardegna. *Editore Carlo Delfino*: 29-56.

HEYDEN, L. V., REITTER, E. & WEISE, J. 1906. Catalogus Coleopterorum Europae, Caucasi et Armeniae Rossicae. *Ed. Reitter*, 775 pp.

HUSTACHE, A. 1936. Coleopterorum Catalogus auspiciis et auxilio W. Junk editus a S. Schenkling. Pars 151. Curculionidae: Cryptorhynchinae. *W. Junk, Berlin*: 1-317.

LUIGIONI, P. & TIRELLI, A. 1912. Una settimana in Sicilia. Escursione entomologica nei dintorni di Palermo e nei boschi di Ficuzza. *Bollettino della Società entomologica italiana* 44: 148-167.

LUIGIONI, P. 1929. I Coleotteri d'Italia, Catalogo sinonimico-topografico-bibliografico. *Memorie della Pontificia Accademia delle Scienze Nuovi Lincei*, serie II, 13: 1-1159.

LYAL, C. 1993. Cryptorhynchinae (Insecta: Coleoptera: Curculioninae). C. H. C. Lyal - *Lincoln, N. Z. Manaaki Whenua Press*, 307 pp.

MAINARDI, A. 1906. Un nuovo genere e una nuova specie italiana della famiglia Curculionidae (*Acallorneuma reitteri* n. g. n. sp.). *Rivista Coleotterologica Italiana* 4 (6-7): 149-156.

O'BRIEN, C. W. & ASKEVOLD, I. 1992. Systematics and Evolution of Weevils of the Genus *Bagous* Germar (Coleoptera: Curculionidae). I. Species of Australia. *Transactions of the American entomological Society* 118 (4): 331-452.

OSELLA, G. 1979. Soil Curculionidae (Coleoptera). *Bollettino di Zoologia* 46: 299-318.

OSELLA, G. & ZUPPA, A. M. 1993. Anthribidae, Apionidae, Attelabidae, Curculionidae del Monte Nerone (e territori viciniori) (Appennino umbro-marchigiano) (Coleoptera, Curculionidae). *Biogeographia* 17(1994): 399-426.

OSELLA, G. & ZUPPA, A. M. 1998. Coleoptera Curculionoidea. *In*: JUBERTHIE, C. & DECU, V. (ed.). Encyclopaedia Biospeologica. *Société de Biospéologie, Moulis - Bucarest (Académie Roumaine).* Vol. 2: 1123-1130.

PORTA, A. 1932. Fauna Coleopterorum Italica. V. Rhynchophora-Lamellicornia. Anthribidae, Brenthidae, Curculionidae, Nemonychidae, Ipidae, Lucanidae, Scarabaeidae. *Stabilimento tipografico piacentino*, 476 pp.

PROTA, R. 1993. Entomofauna delle aree montane. *In*: Montagne di Sardegna. *Editore Carlo Delfino*, 105-125.

REITTER, E. 1912. Bestimmungs-Tabellen der europäischen Coleopteren. LXVIII. Bestimmungs-Schlüssel für die Unterfamilien, Tribus und Gattungen der Curculionidae. *Verhandlungen naturwissenschaften Verein Brünn*, 87 pp.

REITTER, E. 1916. Fauna Germanica. Die Käfer des Deutschen Reiches. Nach der analytischen Methode bearbeit. *K. G. Lutz' Verlag, Stuttgart*, 168 pp.

SOLARI, A. & SOLARI, F. 1908. Curculionidi della fauna paleartica. Note e descrizioni. III. *Bollettino della Società entomologica italiana* 40: 258-281.

SOLARI, F. 1938. Curculionidi nuovi o poco conosciuti della fauna paleartica. VI. *Bollettino della Società entomologica italiana* 70: 27-29.

SPARACIO, I. 1999. Coleotteri di Sicilia. Parte terza. *L'Epos*, 191 pp.

STÜBEN, E. VON P. 1998. Die südeuropäischen Arten der Gattung *Echinodera* Wollaston und die Gattung *Ruteria* Roudier stat. n. (Coleoptera: Curculionidae: Cryptorhynchinae). *Beiträge zur Entomologie, Berlin* 48 (2): 417-448.

STÜBEN, E. VON P. 1999a. Die westpaläarktischen Arten der Gattung *Onyxacalles* n. gen. (Coleoptera: Curculionidae: Cryptorhynchinae). *Entomologische Blätter* 95: 175-203.

STÜBEN, E. VON P. 1999b. Taxonomie und Phylogenie der westpaläarktischen Arten der Gattung *Kyklioacalles* g. n. (Coleoptera: Curculionidae: Cryptorhynchinae). *Stuttgarter Beiträge zur Naturkunde, Serie A (Biologie)* 584: 1-38.

STÜBEN, E. VON P. & WOLF, I. 1998. Der Artstatus von *Acalles provincialis* Hoffmann aus den Meeralpen (Coleoptera: Curculionidae: Cryptorhynchinae). *Nachrichtenblatt der Bayerischen Entomologen* 47 (1/2): 36-44.

STÜBEN, VON P. & BEHNE, L. 1998. Revision der *Acalles krueperi*-Gruppe mit Beschreibung der Gattung *Dichromacalles* g. n. und der Untergattung *Balcanacalles* subg. n. (Coleoptera: Curculionidae: Cryptorhynchinae). *Entomologische Blätter* 94: 11-32.

SWOFFORD D. L., 1993. PAUP Phylogenetic analysis using Parsimony, Version 40b8. Computer program distributed by the Illinois Natural History Survey, Champain, Illinois.

WINKLER, A. 1927-1932. Catalogus Coleopterorum regionis palaearcticae. II. F. Rhynchophora. *Ed. Winkler* : 1370-1647.

ZUPPA, A. M. & OSELLA, G. 1999. Revisione del genere *Aparopion* Hampe, 1861 (Coleoptera, Curculionidae, Molytinae). *Bollettino del Museo civico di Storia naturale di Verona* 23: 1-48.

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